JAN 24 1884

THE TELEGRAPHIC JOURNAL AND
Electrical Review.
VOL. XIV.—NO. 320.

ELECTRIC LIGHTING APPARATUS FOR RAILWAY CARRIAGES.

As may be gleaned from those of our columns devoted to electric lighting notes, the activity which has of late been displayed in several quarters in the endeavour to introduce the electric light into our now dimly illuminated railway carriages, shows no signs of abatement.

The past week has witnessed the experimental trials of two systems, the one a combination of dynamo machine and accumulators, and the other dependent on the dynamo alone. We observe that the cost of lighting by the first arrangement is estimated to be much cheaper than gas, and only a trifle more costly than oil, and that the expense attached to the employment of the second method is expected to be less than that of oil.

In the dynamo-accumulator combination the machine is driven by a belt from the axle of one of the wheels, (of the brake van, we presume, for the apparatus is said to be entirely in the charge of the guard); but the other system is that of a small engine and dynamo placed on the locomotive, the boiler of this latter to supply steam for the dynamo driving engine.

It will be within the remembrance of our readers that the experiments in railway carriage lighting by means of electricity, during the last two months or so of the bygone year, were made with primary batteries. In spite of all that has been said to the contrary, the production of electrical energy by this means is many times more expensive than is the case when dynamo-electric machines are employed, even if we accept the figures given by the inventors and advocates of the most recent forms of battery. We cannot, however, give credence to figures which are, or usually appear to be, based upon the results of a single trial trip, or what is more likely to be the case, given as a mere guess at the probable cost. We do not know of a single instance in which these primary batteries have been placed in the hands of an electrician of repute, for the purpose of having them thoroughly tested and reported upon. In France, on the other hand, the elements of Trouvé, Lalande and Chaperon, and others, have been tested in almost every conceivable manner, and the results published at length. Why is not the same course pursued in this country, and how long must we wait for the necessary data of the batteries of Holmes, Ross, &c.?

It would be best for inventors, speculators, and the general public, to know exactly what these apparatus are capable of now, and to gather from that what the probabilities are of their successful development.

Although the use of primary batteries is, perhaps, the most simple method for producing electrical energy, yet, from reasons of economy alone, they cannot be expected, as at present constructed, to compete with steam-driven dynamos.

Another drawback to the employment of primary batteries is often overlooked. Whilst with a dynamo-electric machine we can increase the electromotive force without materially altering its internal resistance, we cannot do this when using batteries, without a corresponding increase of such resistance.

It does not then require much consideration to lead one to the belief that the dynamo, either with or without the secondary battery, must be employed for a successful, economical, and permanent installation of railway carriage lighting.

That this may readily be accomplished by one of the means herein mentioned we feel sure.

Turning to the combination system it will be at once seen that the liability to mishaps is greater than can be the case with its more simple rival.

The secondary battery may become short-circuited or a connection may part, the driving belt of the dynamo may be broken or slip off, and an accident may happen to the machine itself. On the other hand, the very complication of the apparatus employed might at times be of service, for in case of accident to the dynamo the accumulators would be expected to furnish the current for a certain period. Secondary batteries, however, for practical and permanent use, are not at present to be relied on, and therefore we do not look for lasting results from the system now being tested on the London, Brighton, and South Coast Railway.

The more simple expedient of using a dynamo coupled to a small engine, mounted on some part of the locomotive, has often been suggested, and the results of the experiments made on the Metropolitan District Railway seem to us highly promising. We think that with a little perseverance this method might be generally adopted, and we base our belief on the fact that this is precisely the manner in which the majority of the successful electric lighting installations on board ship have been carried out.

The machines of Siemens coupled direct to Brotherhood engines, those of Edison to the engines of Westinghouse, and the machines of both Edison and Siemens in connection with the engines of Messrs. John and Henry Gwynne, are examples of what has been, and what may be, accomplished. Why should not railway carriage illumination be as successfully carried out by the means now on trial between Kensington and Putney, as the electric lighting of ocean-going steamers?

It might happen that engine, machine, or both, would break down, but experience shows that such a combination, when properly carried out, has the majority of chances in its favour.

We have before stated, that anything electrical in connection with railway work should be of the simplest nature, and therefore we should be much more inclined to place our confidence in the system applied to the Metropolitan District Railway than in that now being tried between West Croydon and London Bridge.

We notice that the experiments on the former line of railway are being carried out under the direction of Mr. J. Staats Forbes, who is chairman both of the Metropolitan District Railway and of the Swan Electric Light, Companies. We trust that this gentleman will see that the trials are thorough and exhaustive, for we feel convinced that the means chosen are the best which can be adopted at the present moment. What improvements time may bring forth is beside the question, for we might wait and wait for something better to turn up and never do anything at all. In the meantime, we are thoroughly assured that appliances are at hand for making the general adoption of the electric light, for railway carriages, as for ship lighting, an accomplished fact.

AN ELECTRICAL METHOD OF READING A THERMOMETER AND HYGROMETER AT A DISTANCE.*

By ARTHUR WM. WATERS, F.G.S., F.L.S.

IN cold districts such as the mountainous regions of Switzerland it is very difficult to find persons willing to go any distance through the snow, early and late, to take meteorological observations, and in consequence meteorologists among the Alps place the instruments in metal boxes just outside their windows. As an invalid, and unable to expose myself to the weather at any hour, I set to work to see if a thermometer could be arranged to be read electrically at a distance.

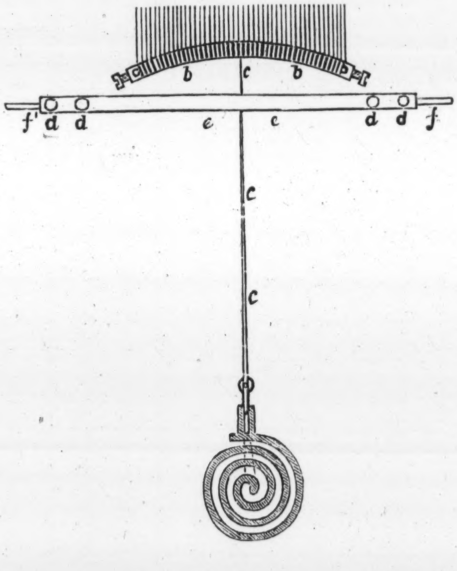

FIG. 1.

Having had my thermometer working satisfactorily for about three months, and having just completed a hygrometer, I feel justified in describing them as practically useful.

Hermann's spiral metal thermometer, which consists of a spiral of two metals welded together, is employed. The centre of the spiral is fixed, and the other end moves a hand. The instrument serves as a maximum and minimum, having two light indices, which are moved to the right or left as the temperature rises or falls, and then are left, one at the highest and the other at the lowest point.

I have also adapted my principle to the hair hygrometer, which moves a hand in the same way as the thermometer.

In order to determine the position of these hands it was necessary to make a satisfactory electrical connection without influencing their indications, as a slight force would either retard their action or move them out of their position.

Eventually the plan was adopted of making the scale with raised wires in connection with a galvanometer in my room. The scales were constructed of pieces of ebonite mounted on hard wood. In the scale, *b*, *b* (fig. 1), grooves were cut in which the wires were laid. The silk covering was removed from a small portion of a length of German silver wire 0·3 millimetre in diameter, and this uncovered part was placed in the grooves, being tightened by drawing its end through holes bored in the hard wood which supported the ebonite. The spaces between the wires were then filled up with shellac, so that a firm and solid scale was made, with alternate metallic and insulating spaces.

The whole scale is supported on two brass pillars passing through it at each end, and this can be raised or lowered, and held in position by the screws shown.

The scale was placed about 1 millimetre below the index, with an electro-magnet, *d*, *d*, on each side, and above these there is a long armature, *e*, *e*, which is attached by watch springs, *f*, *f*, to two pillars, being less than a millimetre above the index, until a current is sent through the electro-magnet, *d*. When the armature is attracted it pulls down the index on to one of the wires, where it is held tightly, thus making a good electrical connection.

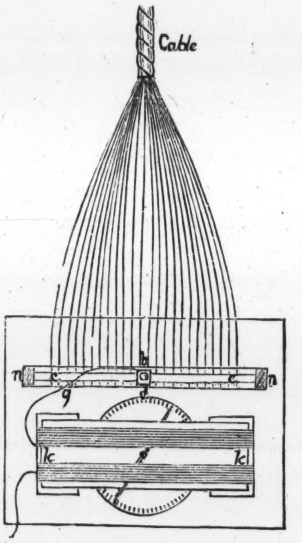

FIG. 2.

The instrument is being worked with a cable containing 25 fine wires, and the thermometer scale is divided to thirds of a degree centigrade.† The cable is 85 metres long, and consists of 25 wires 0·2 millimetre in diameter and 5 wires 0·4 millimetre in diameter, in both cases double cotton covered. One leading wire is electrically connected with the index of the thermometer, and another with that of the hygrometer. This is not fastened to the index, as the free action might thus be interfered with, but to its bearing. In this way the electrical current passes along the index, and as soon as the circuit is closed by the index being brought into contact with one of the wires of the scale it is shown upon a small galvanometer in the room.

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* From the *Quarterly Journal of the Meteorological Society.*

† Since the above paper was written, the author has completed another instrument, in which the divisions were to 0·1° C., and as the weak point of the system is the slow action of the thermometer, he had a more sensitive thermometer made by Hermann and Pfister, of Berne. This consisted of two spirals a short distance apart and connected up to work the same index. The spirals were made of steel and brass, instead of iron and brass, and could thus be smaller, and more sensitive. The divisions being to 0·1° C. the scale was longer, and so it was found advisable to adopt an armature with a double curve instead of the straight one. As a series in this case only represented 2·1° C., he attached small blocks of insulated German silver to the under side of the armature, which, when drawn down, made contact with the index, and by means of thin wire leading from each block was able to tell when contact was made in the same way as with the scale. This is probably better than the plan first used, where each wire of a series had a certain measured resistance inserted.

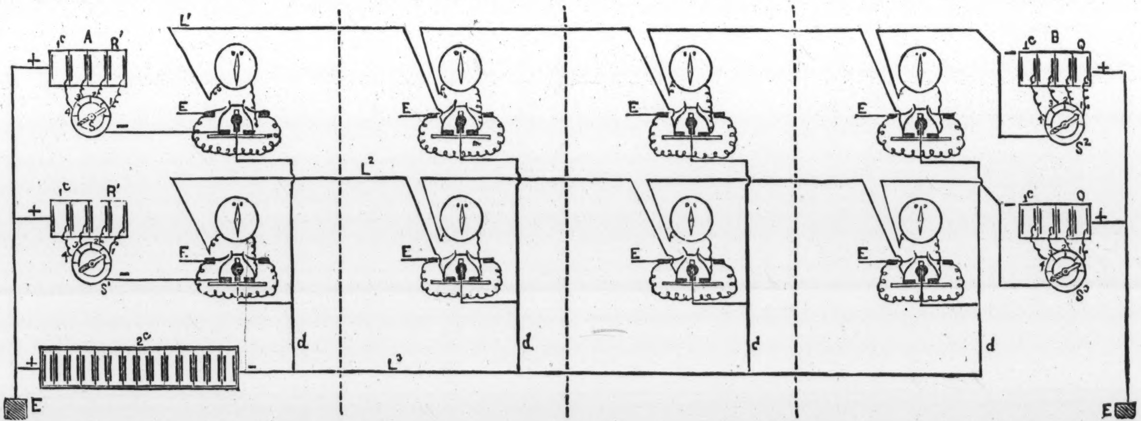
The apparatus for reading the temperature indicated is as follows (fig. 2) :—

Twenty-one stout wires are laid upon a square piece of wood, and attached severally to the ends of the wires of the cable. A brass spring, running loosely on a brass bar, *c*, is placed above the stout wires, and then one of the wires, *g*, of the galvanometer is fastened to the upper end of this spring by means of a binding screw, *b*.

It will be seen that if the index of the thermometer is touching one of the wires of the scale it is only necessary to bring the spring over the corresponding wire to close the circuit, which will be indicated upon the galvanometer. This is done by sliding the spring along the bar, *c*; and when the right wire is reached, the galvanometer needle is deflected. Any simple compass or astatic galvanometer is sufficient for taking the readings.

The galvanometer, *k*, *k*, is attached to the same small board as the "reader," *n*, *n*, and in this way, by having a sufficiency of spare cable, the board with reader and galvanometer can be carried about and by using a battery, as Leclanché's or Daniell's, can be even used in bed, the board being placed on a table by the bed ready for the early morning observation.

A small battery only is required, as two moderate-sized Leclanché cells will work the magnets, and one small Leclanché cell is sufficient for the thermometer index and galvanometer in circuit.



HOUGHTON'S SYSTEM OF TELEGRAPH WORKING.

IN the arrangement of telegraphic circuits it is usual to place at each station the batteries required for working the instruments there. Mr. E. J. Houghton, telegraph superintendent of the London, Brighton, and South Coast Railway, has recently devised an arrangement by which the necessity of having batteries at each intermediate station is obviated, and thus the expense and trouble necessarily attendant on keeping a large number of batteries at distant points constantly in working order is avoided.

According to the invention, the inventor works one or more circuits from batteries placed only at one, or both, of the terminal stations; this is done in the following manner :—If there are one, two, or more circuits running from, say, A to B, also from A to any intermediate point between there and B, or from B to any point intermediate between there and A, a wire is led from A to B, called the battery wire, and to each end of it is joined a battery of an electromotive force, 2^c, placed respectively at A and B, both ends being connected to poles of the same name, say, for instance, each to the negative pole of the respective batteries; the other pole of each of the batteries is put to earth, so that the batteries balance each other. The two ends of the instrument line wire of each circuit is then joined to the similar pole of a battery of, say, 1^c electromotive force (the poles to which they are connected being of the same name as those to which the battery wire is connected, say the negative poles) and the other poles are put to earth, so that the batteries placed respectively at the ends of each line wire balance each other.

In some cases, as shown in the fig., but one battery is used in connection with the battery wire, which may be either at A or B, and the battery wire is joined to the battery pole of a similar name to that joined to the instrument circuit wire, the other pole being put to earth. In circuits where reverse currents are used, arrangements are made so that whenever the operator at a station works his instrument, one side of the line instrument circuit shall be put to earth and the current of 2^c electromotive force from the battery wire shall be joined to the other side of the line instrument circuit. Then the 2^c battery current being of greater power than that of 1^c will overcome it and cause the needle or needles to be deflected, whilst the other portion of the line wire being put to earth, the needles at all stations between the operating station and the other end of the circuit will be deflected in a similar manner. A reverse movement of the needles will take place when the current of 2^c electromotive force is sent in the opposite direction.

To enable this to be done on single needle instruments without causing irregular or hesitating movements of the needles, the fittings of the instruments are so arranged that the instrument circuit wire shall be disconnected before the 2^c battery is joined to it.

The fig. represents two needle circuits arranged for working on this system, L^1 and L^2, indicate the two line wires, each of which is connected to the negative poles of two batteries, one at each of the two terminal stations marked A and B respectively, of, say, 1^c electromotive force and indicated by the letters and figures R, R^1, Q, Q^1.

The instruments in each circuit are so connected when they stand in their normal position for receiving, that the current can flow from one battery towards the other through the instruments and dials, but as the currents from the batteries at each end of the circuits oppose each other, and as the switches are regulated to keep the opposing currents balanced, no deflection of the needles takes place.

At L^3 is shown the special battery wire, to which is connected the negative pole or poles of one or more batteries of greater power than those marked 1^c, say of 2^c electromotive force, the positive pole or poles of which batteries being put to earth, as are also the like poles of the other batteries. Leading or shunt wires from the battery wire are led to the axle of each of the instruments, which may be arranged on any number of circuits fitted on this system, two circuits only being shown in the fig. These leading or shunt wires are shown at *d*, *d*.

On moving the axle of any instrument in either circuit to the right, the right-hand line spring is pushed over by the top hammer, this disconnects the line and immediately afterwards connects it to one of the earth springs. It also connects the axle to the left-hand line spring by the bottom hammer, this causes the current of 1° electromotive force, originating in one of the batteries marked Q, to flow from earth through the earth spring, through the line spring, and thence through the dial (deflecting the needle to the right), the current then passes to the line, and through all stations and dials towards B, deflecting all the needles to the right and through the regulation switch, S^2, to the battery, Q, and thence to earth, making the circuit complete.

The same movement of the axle by making contact between the lower hammer and the base of the line spring, causes the current of 2^e electromotive force to flow from earth to and through the 1^e battery, R, at station, A, which it overpowers, through the regulation switch, S, through all instruments and dials towards the working instrument, thence to the base of the line spring on to the lower hammer, thence to the shunt or leading wire, *d*, thence to the battery wire, L^3, on to the 2^e battery, making the circuit complete, and causing, by virtue of the superior power of the current from 2^e battery, all the needles between A and the instrument worked to be deflected to the right.

When the axle is turned to the left, the current is sent and received in the opposite direction, that is to say, from 1^e battery, R, station A, through the earth wire, through the earth spring, the line spring, and thence on to the line wire through all instruments and dials to the regulation switch, S, thence to 1^e battery, R, station A, making the circuit complete and deflecting all needles to the left. The same movement of the axle by making contact between the lower hammer and the base of the line spring, causes the current of 2^e electromotive force to flow from earth through the battery 1^e, Q, at station B, through the regulation switch, S^2, through all instruments and dials towards the working instrument, thence to the base of the line spring on to the lower hammer, thence to the shunt or leading wire, *d*, thence to the battery wire, L^3, and on to 2^e battery, making the circuit complete and causing, by virtue of the superior power of the current from the 2^e battery, all the needles between B and the instruments worked, to be deflected to the left. It will be seen that by this arrangement two opposite deflections of the needles are obtained by the use of currents of the same name. The inventor points out that the 2^e battery can be tapped at any point for other purposes besides the working of the instruments.

DETERMINATION OF THE RESISTANCE OF LIQUID CONDUCTORS AND GALVANIC BATTERIES AND ON A UNIVERSAL RESISTANCE MEASURER.

By Prof. F. KOHLRAUSCH, of Würzburg.

DETERMINATIONS of resistance frequently do not require the greatest accuracy. For practical purposes errors of 1 or 2 per cent. are often not important. Frequently the objects to be determined cannot even be accurately defined.

This is, as a rule, the case with the resistance of liquids, and still more of galvanic batteries. The very circumstance that these resistances may decrease by per cents. for every degree of changes of temperature determines, under ordinary circumstances the above-named uncertainty. But the resistance of galvanic elements is affected also by a variety of contingencies, by the filling, by the earthenware cells, and finally it changes in time, and with use, to such an extent, that an accurate determination has no meaning.

A little apparatus is here to be described which enables any given resistance—especially those of electrolytes and galvanic batteries—to be determined with great ease and with an ordinarily sufficient accuracy.

As technical literature seems to me not to do full justice to the meaning and the difficulties of the subject a little introductory matter will be necessary. The methods of determining the resistance hitherto in use, especially of galvanic elements, are still less trustworthy than the objects to be measured. In inexperienced hands polarisation and the want of constancy of batteries lead to results which are simply absurd, and even care and criticism do not always lead to the mark. For instance, the method which bears the name of Ohm is really available only for sulphate of copper elements of great resistance, such as those of Meidinger. The various zinc-carbon elements, and even the Daniell in its ordinary form, are on a short circuit no longer constant, *i.e.*, the electromotive force depends on the strength of the current, and the introduction of resistances involves other sources of error.

The resistances of non-constant batteries were altogether incapable of determination by the old methods.

The ingenious compensation method of Von Waltenhofen and Beetz, and the application of Wheatstone's bridge for the same purpose, as proposed by Mance, rendered it possible to solve this problem, but only with the caution of an experienced hand.

Evidently, however, the difficulties of measuring resistances for liquid conducters in general, and especially for galvanic batteries, are overcome by the application of alternating currents. The object to be measured is introduced, as first done, by Groteian and myself, into a branch of Wheatstone's bridge. As a current-exciter there is used, not a constant battery, but a magnet revolving rapidly in a multiplier, or still more simply, the induced bobbin of a suitably arranged Neef's hammer. When the alternating currents disappear in the bridge the well known proportion between the four branches holds good.

As a current-tester for the alternating currents, we took originally Weber's electro-dynamometer; when Bell's telephone and its astonishing sensitiveness became known, its application as a current-tester, especially in the bridge, was proposed in various quarters. The first series of measurements of liquid resistances, with alternating currents and the telephone, were executed at my request by Herr Long, and before the proposals of other authorities had become known.

That the resistance of galvanic batteries may also be conveniently investigated by the same process was first shown by Herr E. Less.

I have already described a combination of simplified instruments for the measurement of resistances. It consists of an induction apparatus for alternating currents, and a Kirchhoff's bridge wire, which, for the sake of accuracy and convenience, is coiled upon a roller.

The arrangement about to be described is a further simplification, especially in two directions. In the first place all the necessary parts are united in the same apparatus; secondly, the graduation at the bridge wire is not carried out in equal parts by length, but so that the parts read off on the scale may give the sought-for resistance without calculation or the use of tables, which is very advantageous for technical use. The whole has been executed in a very satisfactory manner by E. Hartmann.

The induction apparatus has not, like the earlier arrangement, a mercurial interrupter but a platinum contact, which acts well. The number of interruptions is 150 per second. The unpleasantly strong noise is reduced by a contact-spring at the interrupter. The external form is that of a Neef's hammer, but the iron core is massive.

For the excitement there is required a Bunsen or a chromic acid element, or one to two Daniell's or Smee's.

For comparing the resistance sought is employed, according to circumstances, Ohm's or Siemens' units, fixed with a stopper arrangement to the pedestal.

The nickel-silver bridge-wire is about 0·3 millimetres thick and 25 centimetres in length. Contact is effected by means of a nickel-silver spring. The graduation, as already remarked, is carried out in such a manner that the figures, Z, show the relation between the left part, *a*, and the right part, *b*, of the wire. The resistance to be measured, X, is connected with the left part, and the known resistance, R (0·1, 1, 10, &c.), is suspended at the right. If the slide is fixed in such a manner that the current in the bridge (or the telephone) disappears, then

$$X : R = a : b$$

and as the quotient, $a : b = Z$, is read off directly. Z merely multiplied by 0·1, 10, &c., gives at once the resistance sought for. Whoever has worked with such a graduation will at once recognise the inconvenience of the ordinary graduation by length.

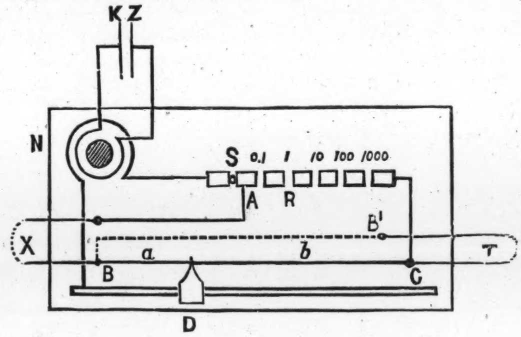


FIG. 1.

The above sketch shows the ground plan of the connections and the application of the whole. The elevation of the principal parts is shown fully in fig. 2. The element here represented is the one under examination for its resistance. The exciting element is not shown.

The alternating current of the outer induced coil of the Neef's hammer, N, branches at A into the resistance to be measured, X, and the resistance, R, the branches of the current at B and C meet the telephone and pass on through the parts, *a* and *b*, of the bridge-wire, and finally through the contact, D, back to the induced bobbin. For the sake of convenience the telephone is not directly appended to the clamp, B, but to B′, which is in connection with B.

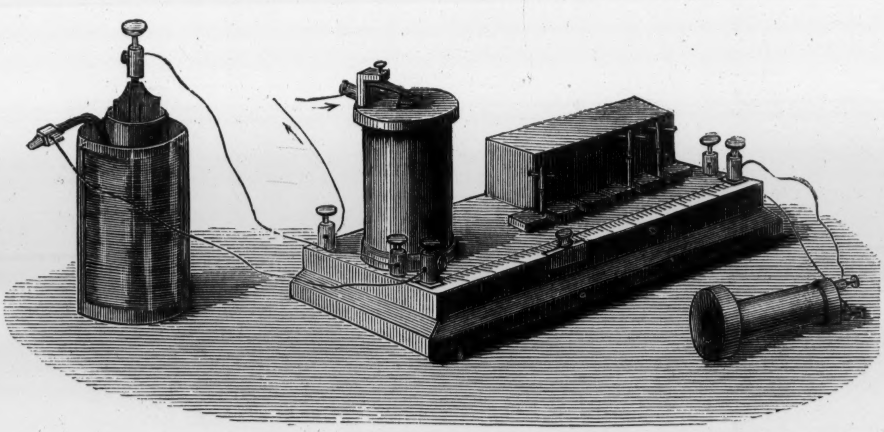


FIG. 2.

In order to determine the resistances of liquids, their electrodes are intercalated at X, and the contact, D, is displaced until the sound of the telephone disappears as far as possible. This does not always ensue completely, and least of all with small resistances between small electrodes. The minimum sound is then taken.

Platinised electrodes of platinum (*i.e.*, covered with platinum black) are most advantageous.

That the comparison-resistance, R, must be as far as possible adapted to the resistance to be determined, so as not to come too near to the ends of the wire, is well known.

Galvanic elements are treated in the same manner. Their constant current does not affect the telephone. In case of powerful elements, such as Bunsen's with large plates, which might heat the bridge-wire, the precaution is taken of determining at once two elements intercalated against each other.

Like Herr Less, we have in general obtained very satisfactory results. The minimum sound can be usually recognised very distinctly. Bunsen elements of little more than 0·1 ohm, large and small Daniell's, chromic acid and manganese elements were easy to measure. Smee's elements gave less decisive sound-minima, and least so when two were introduced in opposition to each other. Daniell's also, singly, or several in the same direction, are more readily measured than when they are introduced in opposition to each other.

Ordinary metallic resistances can naturally be examined with the telephone when the wires are not coiled. In the latter case the results would be disturbed by the extra currents.

Hartmann has devised an arrangement so that by withdrawing the stopper, S, and turning a small crank-contact (not shown in the figure) the two bobbins of the induction apparatus can be readily thrown out, and the element directly introduced as a current-producer. A galvanoscope is then taken in place of the telephone, and the instrument is ready for the ordinary determination of resistances with the bridge.—*Zeitschrift des Electrotech Vereins.*

PROTECTION FROM LIGHTNING.

[A COMMUNICATION.]

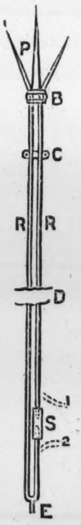
THE recent failure of a lightning protector on Chichester Cathedral to perform its proper functions, has again drawn attention to a subject, the interest in which seems to crop up now and then by fits and starts, and to die away as rapidly. Next to having a properly constructed and effectively fitted lightning rod attached to buildings, is the means for easily and periodically testing the electrical conditions of these safeguards to life and property.

The readers of the ELECTRICAL REVIEW are doubtless well aware that Mr. Samuel Vyle patented, some years since, a lightning conductor which had for its primary object a simple device for enabling electrical tests to be taken without the necessity, which formerly existed, of climbing up to the highest point of the conductor for the purpose of affixing a wire thereto. Mr. Vyle's invention consists in the addition of an insulated wire to the strand of an ordinary conductor; the wire is placed inside the strand and attached at its upper extremity to the base of the air terminal or point of the rod. Its lower end is at the command of the inspector, who can thus take all necessary tests with ease, to ascertain the state of the conductor.

It has, however, always appeared to me to be possible, and indeed probable, that unless the insulating covering of the inner wire be very thick, that the surrounding strand might make short circuit with it at any point between the earth and air terminals, and in such a case it would be impossible to tell whether the air terminal was or was not in good metallic connection with the rod. Be this as it may, I think that the very simple device of Mr. Vyle does not yet appear to be sufficiently well known or taken advantage of by those whose business it is to erect such apparatus.

I have been long impressed with the idea that Mr. Vyle's method of testing lightning conductors, simple though it be, might yet be improved upon; and yielding to this conviction, I make bold to place my suggestions before your readers. When the sectional area that a lightning rod shall have has been determined, I think that it matters little whether the conductor be a single one or divided into two, so long as both arrangements contain the same amount of metal. This being the case, I would suggest the construction to be carried out as shown in the sketch attached hereto.

P represents the air terminal, to the base of which, B, I would separately attach the two rods, bands, or small strands, R, R, as shown; these would be carried down the building, one continuously, but the other having a junction at a convenient distance from the ground for testing purposes, and to prevent tampering with, at S. They could be joined together at E, which represents earth, the best methods of making which I need not here particularise. The two portions of the conductor might be kept apart throughout their length by porcelain wedges, or other simple means, as at C. I have shown the rods broken at D, so as to economise space in your valuable columns. In the method here suggested, not only could all electrical tests be taken with facility and rapidity from the disconnected ends, 1 and 2, at S, but the extra advantage of seeing every portion of the conductor would be gained. That any short circuit throughout the two portions of the conductor would occur, is unlikely; and if it did, the inspector could see at a glance where it was situated. By testing between points 1 and 2, the two rods being joined at E, it would readily be seen whether the upper extremities of the rods were in good metallic contact with the air terminal, P. The condition of earth could be ascertained from either 1 or 2, and a separate earth, such as a water pipe, could be used as a standard. I have been informed that the late Sir C. W. Siemens proposed a somewhat similar conductor to the above, by dividing the strand one on one side of a building and one on the other. This, however, would not be so convenient for testing purposes—and the testing of lightning conductors should be often and carefully performed if they are to be relied upon—nor could any mechanical defects be so readily seen.



I hope I have made my suggestions clear, and if I dared only to think that anything in my communication would call attention to the fact that lightning conductors when erected require as much looking after and attention as other electrical apparatus, my purpose would be more than accomplished. As a matter of fact, however, it is only too evident that when a lightning rod is once fixed nothing further is ever thought of it, until suddenly its failure to perform that which was expected of it reminds us that it *ought to have been tested before.*

MUSICUS.

A PRACTICAL METHOD OF PHOTOMETRICALLY COMPARING ORDINARY SOURCES OF DIFFERENTLY COLOURED LIGHT.*

(Note by M. J. MACÉ DE LÉPINAY, presented by M. DESAINS.)

THE problem of which I propose to give a practical solution is one of those laid down by the International Congress of Electricians. The direct photometric comparison of two sources of light differently coloured is always possible. It is indeed comparatively easy in the case of ordinary sources, the colourings of which never vary much. But even in this case a certain education of the eye is required; this is a serious inconvenience which I propose to overcome.

For this purpose I give the following law, laid down by Becquerel, which served M. Crova as a starting point in his researches on the optical measurement of high temperatures: *when bodies of the same temperature and of different powers of emission are placed in a dark enclosure, they give out lights very different in intensity, but of the same composition.* This law, as M. Crova has remarked, is directly applicable to the ordinary luminous sources, which all consist of solid particles rendered incandescent by the high temperature to which they are brought.

Let I be the intensity† of one of these sources, deduced from direct comparison with the Carcel standard. Let us, on the other hand, designate by R, the intensity measured on the spectro-photometer of one of its red rays, with the length of wave determined, compared with that of the same kind of ray of the Carcel standard, and by V, the intensity also defined of one of its green rays. If we substitute for this first source another of the same temperature, the three quantities, I, V, and R, will remain proportional, and consequently for all these sources the two terms $\frac{\mathrm{I}}{\mathrm{R}}$ and $\frac{\mathrm{V}}{\mathrm{R}}$ will retain the same values. If we suppose, on the other hand, that the temperature of the source in question varies continuously, it will be the same with the composition of the ray emitted, and consequently the two terms $\frac{\mathrm{I}}{\mathrm{R}}$ and $\frac{\mathrm{V}}{\mathrm{R}}$ will vary continuously. We are, therefore, in a position to state that

$$(1) \qquad \frac{\mathrm{I}}{\mathrm{R}} = f\left(\frac{\mathrm{V}}{\mathrm{R}}\right)$$

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* *Comptes Rendus, Dec. 17th,* 1883.

† It is correct to employ the expression *intensity*, for I have several times assured myself that the intensity of the Purkinje phenomenon is *nil*, or at least inappreciable, even in the most unfavourable condition of solar radiation, compared to the Carcel standard.

Let us now suppose that from a sufficient number of experiments we are enabled to determine the nature of this expression, $f\left(\frac{V}{R}\right)$; it will be enough, in order to calculate by means of equation (1) the intensity of any ordinary source whatever, to measure R and V: *it is therefore possible to substitute for the direct measurement of the intensity of the source two measurements of the intensities of rays of the same kind.*

By this method, however, the solution of the problem would not be yet practical, for it would necessitate the employment, always delicate, of a spectro-photometer. But the accuracy of the reasoning remains unimpaired if we substitute for the relative measurements, as has been supposed with rays of a determined length of wave, in the red and the green, measurements effected by means of the Foucault photometer, observing the shadows through two solutions, one red and the other green, on condition:—

1. That they should be always employed in the same condition of concentration, and with the same thickness;
2. That they shall supply simple rays of such a kind that in any case (for example that of solar radiation compared to the Carcel standard), the two surfaces compared shall be of the same colouration.

The solutions which seemed to me to fulfil the above conditions best, are: a solution of perchloride of pure iron in water at 38° B, and a solution of chloride of pure nickel in water at 18° B.*

With a view to determine experimentally the expression, $f\left(\frac{V}{R}\right)$, which figures in equation (1), fifty-two measurements were taken, comparing successively with the Carcel standard, a moderator lamp with a straight chimney, a similar lamp with a bent chimney, a petroleum lamp, the Drummond light, and finally, the sun light, diffused by a screen whitened by sulphate of baryta. These last experiments were effected towards the summer solstice.†

Not being here able to enter into details, either of the experiments or of the calculations (effected by the method of the least squares), I shall content myself with giving the following formula, which sums up the whole of these measurements:

$$\frac{R}{I} - 1 = 0{\cdot}208\left(1 - \frac{V}{R}\right).$$

It is by means of this formula that the following numerical table has been calculated, which is quite sufficient for all applications:—

$\frac{V}{R}$	$\frac{I}{R}$	$\frac{V}{R}$	$\frac{I}{R}$
0·8	0·96	2·0	1·26
1·0	1·00	2·2	1·33
1·2	1·04	2·4	1·41
1·4	1·09	2·6	1·50
1·6	1·14	2·8	1·60
1·8	1·20		

In order to show the degree of accuracy obtained by the proposed method, I will quote first the results of a verifying experiment, made on a Swan incandescence lamp of 12 volts ($i = 0{\cdot}95$ ampères); it was found that $V = 0{\cdot}167$, and $R = 0{\cdot}184$. From this we get $\frac{V}{R} = 0{\cdot}908$, $\frac{I}{R} = 0{\cdot}98$, and consequently $I = 0{\cdot}180$: the direct experiment gave $I = 0{\cdot}182$. We will quote further the results obtained in one of the experiments taken at random, relating to the Drummond light. It was found that $V = 6{\cdot}59$, and $R = 5{\cdot}04$, whence $\frac{V}{R} = 1{\cdot}31$, and consequently $\frac{I}{R} = 1{\cdot}07$, and $I = 5{\cdot}39$. The direct measurement gave $I = 5{\cdot}43$. The discrepancies in other experiments have sometimes been greater, but even in the case of the sun, they have never exceeded one-fiftieth.

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* An error of 1° or 2° B, more or less, in the degree of concentration of one or the other of these solutions has no appreciable influence.

† All these experiments were made on the principle of equal clearness (shadows of the same clearness). I propose to resume them, taking as a starting point, the principle of equal visual sharpness.

REVIEWS.

Traité Pratique d'Électricité; comprenant les applications aux Sciences et à l'Industrie. Par C. M. GARIEL. Vol. I. Paris: Octave Doin, 8, Place de l'Odeon.

This work consists of over 400 pages, and is illustrated with over 250 cuts. It forms the first of 2 vols., the second of which will be published during the present year.

The author states in the preface that electricity has now entered a new period, namely, that of its industrial applications, as distinct from telegraphy and galvanoplastie, consequently a great interest in such matters has sprung up. The books hitherto published on electricity have been written for a particular section of the public—for savants, or for industrial engineers who are already conversant with the general questions involved. Other works have dealt with the subject in a popular manner. The author has endeavoured to produce a work of an intermediate character, for which he believes there is a demand. Departing from the usual course, M. Gariel deals with magnetism first, and then with static and dynamic electricity.

The section on magnetism (40 pages) contains the usual matter found in electrical treatises with the addition, however, of mathematical statements of the laws which govern the actions of the various magnetic instruments, such as the dipping needle; the action of an oscillating magnet, the action of one magnetic pole or another, and similar problems, are mathematically explained briefly.

Static electricity is dealt with in 60 pages, and the contents of the latter present few, if any, new features, in fact, page after page, we come across the familiar illustrations which have done duty in more than one work on electricity. The descriptions, no doubt, are slightly different from those previously given, but that is all that can be said of the matter.

The subject of dynamic electricity, which forms the third portion of the work, is carefully dealt with; and the various actions of currents on each other are well explained. The portion devoted to the calorific effects of currents though brief, is good.

Following the section on dynamic electricity, we have a chapter on the system of absolute units, which, although well written, does not call for any particular remark.

We next have magnetic measurements considered, and then a considerable number of pages are devoted to descriptions of various forms of galvanometers together with theoretical explanations of their action; along with these descriptions we have given methods of measuring electromotive forces. The measurement of resistances by the Wheatstone bridge is also explained, and methods of determining the resistance of batteries are given.

The latter portion of the book is devoted to a description of electrical machines, batteries, and induction machines.

Taking M. Gariel's work as a whole, we must confess to not being satisfied with it. The author certainly shows that he is well acquainted with his subject, but he has really added little, if anything, to the information which is already given in other treatises on electricity. The arrangement of the matter is decidedly unsatisfactory, the various distinct points considered being mixed up quite unnecessarily. In fact, the general impression given by the book is, that M. Gariel has taken a few well-known text books, and having extracted certain portions from them, has modified the text, and then arranged the latter with a great disregard for continuity.

The Railway Diary and Officials' Directory for 1884. London : McCorquodale & Co., Limited.

This diary contains full information concerning the composition of the directorates of all the railway companies in Great Britain ; lists of the names of the principal officials are also included. The capital accounts, revenue accounts, returns of traffic for the first 26 weeks of the first half years, 1883-1884, are also given in the case of the principal railways. A good almanack adds to the value of the book, which recommends itself.

Clark's Transit Tables for 1884. London : E. and F. N. Spon, 16, Charing Cross.

These tables are prepared principally for the use of those who have no practical acquaintance with astronomy, but who desire to use a transit instrument to obtain accurate time from the stars. No calculations are required. The use of the transit instrument is very simple, and the latter certainly might be adopted with advantage in many cases where a verification of time is required. Mr. Latimer Clark's tables are not only very useful, but they also afford a means of considerable amusement and instruction to those who have a taste for the principles of astronomy.

ON THE FUNDAMENTAL NOTIONS OF ELECTROSTATICS. (QUANTITY, POTENTIAL, CAPACITY, &c.)

By E. MACH.

A discourse delivered at the International Electrical Exhibition in Vienna, September 4th, 1883.

THE task has been allotted to me to develope in a generally intelligible manner, the quantitive fundamental notions of electrostatics, *electric quantity*, "potential" "capacity." It would not be difficult even within the limits of an hour, to occupy the eyes with a variety of beautiful experiments, and to fill the imagination with manifold conceptions. But we should still be far removed from a clear and easy comprehension of the facts. We should still lack the means of accurately reproducing the facts in our thoughts, a matter of equal importance for the theorist and the practician. The means required are the fundamental conceptions of the doctrine of electricity.

As long as only a few scattered enquirers are engaged with a subject, and every experiment can be easily repeated, an occasional description suffices to fix the experience collected. The case is different when each must utilize the experience of many, as is the case when science has acquired a broader base, and especially as soon as it begins to afford space for an important branch of technology and derives observations from practical life on a large scale. The facts must then be described in such a manner that everyone can everywhere constitute them mentally from few and easily procurable elements and reproduce them according to the descriptions. This is effected with the aid of the conceptions of measurement, and of international measures.

The work begun in this direction in the epoch of pure scientific development, especially by Coulomb, Gauss (1833), and Weber, has been powerfully promoted by the requirements of the great technical undertakings, felt especially since the laying of the first Atlantic cable. and has been brilliantly completed by the labours of the British Association (1861), and the Congress of Paris (1881), and especially by the exertions of Sir W. Thomson.

It is evident that in the allotted time I cannot lead you by all the long and circuitous roads which science has actually taken. It is not possible at every step to remind you of all the little precautions to avoid error, which the beginning of our career proved to be necessary. I must make use of the simplest and crudest facts. I will lead you by the shortest ways from the facts to the ideas, and it will not be possible for me to anticipate all the collateral trains of thought which may present themselves.

We consider two small, equal, light, freely suspended bodies (fig. 1), which we electrify either by friction with a third body, or by contact with a body already electrified. Forthwith there is manifested a repulsive power which, in opposition to the action of gravitation, drives the two bodies away from each other. This power would be able to reproduce the same mechanical power by which it has originated.

Coulomb convinced himself by very elaborate researches with the torsion balance, that when these bodies at the mutual distance, *e.g.*, of 2 centimetres, repel each other with the same force with which a milligramme weight endeavours to fall to the earth, then at half the distance they repel each other with a force of 4 milligrammes, but at double distance (4 centimetres) only with a force of $\frac{1}{4}$ milligramme. He found in other words that electric force acts inversely as the square of the distance.

FIG.1.

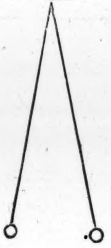


FIG.2

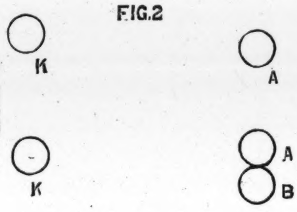


FIG.3

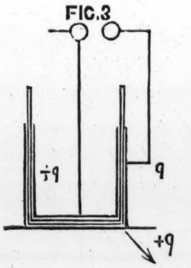
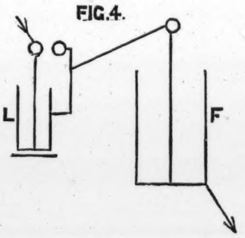


FIG.4.



Let us now suppose that we had the means of measuring electric repulsion by weights—electric pendulums afford such means—we might then make the following observations :

The body, A (fig. 2), is repelled by the body, K, at 2 centimetres distance, say, with a pressure of one milligramme. If we bring A in contact with an equal body, B, half of this repulsive force passes to the latter. Both A and B will now at 2 centimetres distance from K be repelled each with half a milligramme, but both together with 1 milligramme. The distribution of electric power among bodies in contact is a fact. It is a convenient, though not a necessary addition, if we conceive that there is present in the body, A, an *electric fluid*, on the quantity of which the electric power depends, and half of which flows over to B. For in the place of the new physical representation, there thus comes one to which we are already accustomed.

In harmony with this conception, we call the unit quantity of electricity, according to the very generally accepted centimetre-gramme-second system, (C. G. S.), that which acts repulsively upon an equal quantity at the distance of 1 centimetre with the unity of force, *i.e.*, with a force which gives the mass of 1 gramme per second an increase of velocity of 1 centimetre. As the mass of 1 gramme receives by the gravitation of the earth an increase of velocity of about 981 centimetres per second, it is hence attracted by 981 (or in round numbers 1,000) units of force of the centimetre-gramme-second system, and a milligramme weight seeks to fall to the earth with 1 unit of force of this system.

Thus we can easily procure a representation of the unit of electric quantity. Two small bodies, K, each weighing 1 gramme, are suspended by very light perpendicular threads, 5 metres in length, so as to touch each other. If both become equally electrified, and withdraw from each other to the distance of 1 centimetre, their charge corresponds to the electrostatic unit of the quantity of electricity, since the repulsion counterbalances the gravitation (= about 1 milligramme) which seeks to draw the bodies together.

Suppose that there is a very small globule counterpoised in a balance, and perpendicularly below it a second globule at the distance of 1 centimetre. If both globules are equally electrified, the one in the balance is rendered apparently lighter by repulsion. If an additional weight of 1 milligramme restores the equilibrium, each globule contains about the electrostatic unity of electric quantity.

With reference to the fact that the same electrified bodies exert different forces upon each other at different distances, an objection might be raised against the measure of quantity as above laid down. What sort of a quantity is that which weighs sometimes more and sometimes less? But this apparent deviation from the ordinary determination of quantities by weight in daily life is, when closely examined, rather an agreement. A heavy mass is less powerfully attracted to the earth on the summit of a high mountain than at the sea-level, and we are able to dispense with a determination of the altitude merely because we always compare a body with a weight at one and the same level.

Were we, however, as Professor Von Jolly proposes, to take two equal weights which counterpoise each other in the balance and then approximate the one decidedly to the centre of the earth by suspending it from a very long string, we should find it show a corresponding predominance in weight.

If we imagine two different electric fluids, the positive and the negative, of such a nature that the parts of both fluids attract each other respectively as the inverse squares of the distance, whilst the parts of each fluid repel each other according to the same law, and if we suppose in non-electrified bodies both fluids uniformly distributed in equal quantities, whilst in electrified bodies one of the two is in excess; and if we further conceive these fluids freely mobile in conductors, but immoveable in non-conductors, we have the representation which was developed by Coulomb with mathematical accuracy. We only need picture to ourselves this representation, to see mentally the particles of fluid of a conductor, *e.g.*, charged positively, withdraw from each other as far as possible, all removing to the surface of the conductor, and there seeking the projecting parts and points until the greatest possible work has thus been effected. On increasing the surface we see an attenuation, but on its decrease a proportionate condensation. In a second non-electrified conductor approximated to the foregoing we see at once the two fluids separate from each other, the negative being collected at the nearer and the positive at the remote side of this second conductor. The advantage and the scientific value of this representation is, that it reproduces and renders visible all the facts which have been gradually collected by laborious observation. Herewith its value is exhausted, and we must not seek far in Nature for the two hypothetical fluids, which we have merely imagined. The theory of Coulomb may be replaced by one totally different, *e.g.*, that of Faraday. It is always best when we have once obtained a general view of the phenomena to return to the facts.

We will now, in the first place, make ourselves acquainted with the notion of electric quantity and the method of its measurement or valuation.

Let us suppose an ordinary Leydon jar (fig. 3), with its inner and outer coatings connected with spark-balls, at the distance of 1 centimetre from each other. If the inner coating is charged with the quantity of electricity $+ q$, there occurs on the outer coating a distribution through the glass. A positive quantity almost equal to $+ q$, flows down into the earth, whilst the corresponding $- q$ remains on the outer coating. The spark-balls receive their share of these quantities, and when q is large enough a spontaneous discharge takes place through the insulating air between the balls. For such a spontaneous discharge of the jar at a given distance and for a given size of the balls, a charge by the given quantity of electricity, q, is needed.

We next insulate the outer coating of the Lane's measuring jar, L, just described, and place it in connection with the inner coating of an outwardly conductive jar, F (fig. 4). Whenever L is charged with $+ q$, then $+ q$ passes to the inner coating of F, and a spontaneous discharge of the jar, L, which is now again void, will take place. The number of discharges of the jar, L, gives a measure of the quantity which was charged into F, and if after 1, 2, 3, &c., successive spontaneous discharges of L, we discharge F, we may convince ourselves of the corresponding successive increase of its charge.

(*To be continued.*)

NOTES.

Electric Lighting.—The following are the principal installations effected by the Edison and Swan United Electric Light Company, Limited, during the year 1883, or at present in course of execution. *Steamships:*—H.M.S. Malabar, Himalaya, Orontes, Indian troopships; s.s. Rio Pardo, Rio Parana, National Brazilian S.S. Company; s.s. Apollo, Minerva, Compagnie La Platense; s.s. Pateena, Tasmanian Steam Navigation Company; s.s. Clan MacArthur, Clan MacIntosh, Clan MacPherson, Clan Mathieson, "Clan" Line; s.s. Takapuna, Wairarapa, Union S.S. Company of New Zealand; s.s. Adelaide, Adelaide S.S. Company; s.s. Valetta, Peninsula and Oriental Company; s.s. Oregon, Guion Line; s.s. Servia, Pavonia, Cephalonia, Cunard Line; s.s. Lonsdale, Captain James Deane; s.s. Rewa, Goorkha, Nerbudda, British India Steam Navigation Company; s.s. Hammonia, Hamburg-American Steam Packet Company; s.s. Doric, Messrs. Harland & Wolff; s.s. City of Rome, Anchor Line; s.s. Tongariro, Aorangi, Ruapehu, New Zealand Shipping Company; s.s. Adriatic, Ismay, Imrie & Co. *Land:*—Holborn Restaurant, House of Commons, A. and S. Gatti, Waterloo Station, City and Guilds Technical College, Criterion Theatre, Laing, White & Wharton, New Law Courts, Nine Elms Station, London; Sir M. W. Ridley, Bart., M.P., Blagdon Hall, Northumberland; Coxon & Co., Newcastle; Captain Markham, Morland, Penrith; Rowntree and Sons, Scarboro'; Webb Brothers, Randalstown, Ireland; C. M. Palmer, Esq., M.P., Loftus, Cleveland; Bowyer & Priestley; Duff & Rowntree; Great Eastern Railway Hotel, Parkeston; T. Richardson, Esq., M.P., Yarm, Yorkshire; W. F. Moore & Sons, Isle of Man; J. H. Gartside & Co., Manchester; Simpson & Denison, Dartmouth. The installation at the House of Commons, which ran so successfully during the last Session, is being increased by the addition of about 220 lamps, which will bring the total number up to 500. The entire plant will be in readiness for the opening of Parliament on the 5th February. The Holborn Restaurant installation, consisting of plant for 500 lamps, is being augmented by additional engines and dynamos for 1,200 lamps, which will make this installation, when completed, the largest isolated plant in England. The Central Lighting Station at Victoria is rapidly approaching completion. The company has at present on hand orders for lighting four additional troopships for H.M. Government—the "Crocodile, "Serapis," "Jumna," and "Euphrates"—besides various contracts for steam ship plants. They are also about to carry out installations at the Cannon Street Hotel; for Messrs. Shanks & Co., Johnstone, N.B.; Messrs. Brown Bros., Galashiels; &c. The amalgamation of the Edison and Swan Companies has taken place, as our readers are aware, during the past year, and the offices of the United Company are now at 74, Coleman Street, London, E.C. S.S. "Ruapehu:" this fine steam ship, the third of three vessels lately built by Messrs. John Elder & Co., of Glasgow, for the New Zealand Shipping Company, went her trial trip on the Clyde last week. Like her sister ships, the "Tongariro" and "Aorangi," she is fitted throughout with the Edison system of electric lighting. The generating plant, which is in duplicate, consists of two 250-light Edison-Hopkinson dynamos, running with full load at about 470 revolutions per minute, and driven by rope belting from two of J. and H. Gwynne's vertical high-speed engines. The "Ruapehu" left the Albert Docks for New Zealand on the 10th instant. Cannon Street Station Hotel: The Edison and Swan Company is about to light the grand and pillar halls of this hotel with about 200 lamps. A Marshall vertical engine and an Edison K dynamo will be used. Factory lighting in Scotland: The Edison and Swan Company is about to instal a 250-light Edison plant at Messrs. Shanks & Co.'s new works in course of erection at Johnstone, N.B. They are also about to lay down a plant of two K dynamos for lighting Messrs. Brown Brothers' new tweed mills, at Galashiels, N.B.

Edison's Indian and Colonial Electric Company is lighting the Parliament Houses at Sydney, New South Wales, under contract with the Government, and also the Government railway station between Victoria and New South Wales. The General Post-office in Sydney is partly lighted, and during the past year the company has lighted the Volunteer Camp at Sydney. In Queensland a contract has been made with the Government to light the Government House, and the Government printing establishment is also being lighted. The first mill illuminated by electricity in the Australian Colonies was fitted up by the Indian and Colonial Company in Queensland. In New Zealand the company is also lighting the Government printing offices at Wellington. The report with reference to the whole of these works in the various colonies has been uniformly satisfactory. In Melbourne the company has been lighting one of the chambers of Parliament House for many months past with the greatest success.

The Anglo-American Brush Electric Light Corporation, Limited, has just completed manufacturing for the South-Eastern Brush Electric Light and Power Supply Company a quantity of valuable apparatus for installation at Baron Rothschild's new mansion at Aylesbury. The most noticeable portion of the plant consists of two of their well-known No. 8 40-light Brush dynamos, which are in this case fitted with a novel and ingenious arrangement by which the machine can be made to give at pleasure a current of either 10 or 20 ampères, the E.M.F. being at the same time altered in an inverse ratio: this is effected by the simple operation of moving the handle of a switch, thus enabling the same dynamo to be used at night for generating the small current which is required for driving the full number of Brush arc lamps for which the machine is designed; and when not so employed it can be made to give double the quantity of current for the purpose of charging storage batteries. It will be seen at once that this greatly increases the amount of useful work which can be got out of these powerful dynamos. Another very important, and perhaps the most striking, feature of the installation is 12 automatic lamps for the illumination of the grounds. They are each of 4,000 candle-power, and are placed on stands, adjustable in height, which are fitted with powerful parabolic reflectors, capable of being turned in any desired direction, in order that they may concentrate a very powerful beam of light on any piece of statuary, fountain, or especially beautiful portion of the grounds, at the same time shedding a flood of light over the whole of the area that they are intended to illuminate. Amongst the other articles supplied are six lamps of an ornamental character for lighting the conservatory.

We glean from the *Hull News*, that on the evening of the 4th inst., the occasion of the annual ball to the tenantry of Mr. C. H. Wilson, M.P., at Warter Priory, the mansion was illuminated by the electric light, which has recently become the means of lighting the Priory, and has been found to answer most admirably. The lighting has been supplied, with all the necessary appliances, by Messrs. J. Edmundson & Co., of 19, Great George Street, Westminster, gas engineers and electricians. The illumination consists at present of 180 Swan incandescent lamps, of various sizes, their lighting power varying from 10 to 40 candles. These are distributed over the whole of the mansion, being tastefully arranged in the reception rooms. Many of the existing candelabra, &c., have been utilized and adapted to carrying the new means of illumination. The large hall and all the passages and corridors through the house, and a few of the bedrooms, are lighted by electricity, as are also the whole of the servants' departments, kitchens, offices, &c. The wires have been easily carried throughout the house, and they are well insulated and protected by wood casings, whilst at every branch a lead safety fuse has been supplied, with a view of guarding against any risk of fire, which might result from the wires becoming heated by any accidental short circuit. The various fittings and brass work for carrying the lamps, where the existing fittings have not been utilized, are neat and simple. The current of electricity is supplied by two dynamo machines, about one hundred yards distant from the mansion, an existing outbuilding having been utilised as an engine-house. The dynamos are each capable of supplying 65 lights of 20 candle power, and are coupled together in such a manner that either or both may be used as required, and they have been made self-regulating, so that when a portion of the lights are turned out the remainder are not affected, but remain at the same degree of brilliancy. As the two dynamos only supply 130 lights, those fitted in the mansion cannot all be kept burning at the same time, but those not required are turned out. We may state that the new illumination is being tried as an experiment to enable Mr. Wilson to judge of the success of the lighting on a small scale first, afterwards to be extended as required by more lights and additional dynamo machines, as it will require nearly 300 lights to thoroughly illuminate the whole premises, including stabling, &c. The motive power is at present supplied by one of Marshall's portable engines of 8-horse power, which will be replaced by a permanent engine when the further extension of the lighting is completed. The whole of the apparatus is easily attended to by one man, and a careful account of the cost of working is being kept. An experience as to the working of the light during the three months it has been in use shows, it is understood, a considerably less cost than is usually the case in such a country mansion when lighted by gas. The light is perfectly steady and most agreeable.

The lighting of the Grangemouth Docks by electricity has now been so far completed that a few of the lamps were lit up on Monday night. The apparatus has been fitted up by Messrs. Norman & Sons, Argyll Street, Glasgow. The engine which has been supplied is made by Lamberton & Co., Coatbridge, and is Well's patent compound, and is supplied with steam from the large boilers which supply power to the other machinery round and about the docks; and although it goes at the rate of 400 revolutions per minute it is quite noiseless and without vibration. It is capable of giving sufficient power to light 12 lamps in all, which have been fitted up by the firm round both the old and new docks. The town will derive some benefit, as one of the principal thoroughfares that leads to the station and Bolness Road, will also be lit by electricity. The Caledonian Railway Company has been at the whole of the expense of this undertaking.

Last week an experiment was tried by the London, Brighton, and South Coast Railway Company, of running a train fitted up with the electric light. The train in question was that leaving West Croydon for London Bridge (viâ the Crystal Palace and Peckham-rye) at 12.15 p.m. The system employed is a combination of dynamo machines and accumulators. When the train was in motion the electric energy was stored and given out as required. Thirty 20-candle incandescent lamps were used. The apparatus was entirely under the control of the front guard, who is empowered to turn the current on and off at pleasure. For example, while the train was running in broad daylight the electric light was not used, but the moment a tunnel was entered it was employed. The electricity is generated by means of a belt connecting the dynamo machines with the axle of one of the wheels. The system is the invention of Mr. Stroudley, of Brighton (locomotive department), and Mr. Edward Houghton, the superintendent of the telegraph department. It is said to be much cheaper than gas and only a trifle dearer than oil. It is understood that the method will be shortly adopted all over the line.

An interesting experiment has been tried on the Metropolitan District Railway, in connection with one of the suburban trains running from High Street, Kensington, to Putney, the carriages of which are lighted by electricity. In carrying this out, a Siemens dynamo and a Willan three-cylinder engine are placed in a luggage van which is attached to the train. Steam is supplied to the engine by means of a small boiler which is also fixed in the van. The carriages are lighted by means of a total of 28 Swan incandescence lamps of 20 candle-power each, which gave a very brilliant light. The present machinery was designed for a longer train, and in addition to the lamps in the carriages, there are about 30 in the van which are always lighted when the others are. The object of this is to ascertain the exact cost of working a sufficient number of lights for the longer trains, which are usually fitted with 50 ordinary gas lamps. The experiperiment is being carried out for Lord S. Cecil, general manager of the District Railway, and Mr. J. S. Forbes, chairman of the latter railway company, and also of the Swan Electric Light Company. The first public trial of the light took place on Thursday afternoon last week, and the results were considered very satisfactory. It is therefore intended to continue the experiment for some weeks, the train being all the time in regular work. In the event of the machinery proving effective and reliable it is probable that a Willans engine and a dynamo will be placed on the engine of the train, so that steam can be supplied from the locomotive boiler. It is anticipated that the cost of lighting a train by electricity direct will be much less than that of oil lamps.

Respecting a note which appeared in our issue of the 15th ult., that, after carefully observing the various systems of electric lighting at the recent Fisheries Exhibition, the "Government officials" purchased a Ferranti dynamo for the purpose of lighting a portion of the South Kensington Museum, we now have it on good authority that the inference to be drawn from this statement, namely: that the South Kensington Museum authorities have chosen the Ferranti machine as the best shown at the Fisheries Exhibition, is not correct, and the reasons for purchasing the machine in question was to make the dynamo machine room for the lighting of the Museum a representative technical collection, containing all good types of dynamo machines, and therefore including one Ferranti machine as typical of a class.

In an article on "divers," which appeared in the *Daily News* of the 4th inst., the writer remarks: "The electric light has now become available for diving purposes, though it does not seem to be used so frequently as might be expected."

We read in an American contemporary that Fire Marshall Sheldon has made an investigation of the origin of the fire caused by electric light wires at No. 121 Fulton Street, New York, on the evening of the 8th December. He reported as follows: An electric light wire of the United States Illuminating Company was resting upon an iron wire attached to a window-sill in the second story of the building and upon the end of a projecting pole used for advertising purposes. The insulation of the wire was chafed off. The current passed the guy wire to the window-sill, where it came in contact with a telephone wire and passed to the telephone box in the building, burning it out, and thence to the telephone station at No. 198 Broadway, doing some damage there.

Mr. Robert Hammond has in the press a work entitled "The Electric Light in our Homes," in which house to house electric lighting, from commercial and domestic standpoints is dealt with. The work will be published by Messrs. F. Warne & Co.

The Hammond Electric Light and Power Supply Company have just successfully completed installations at the Prince of Wales' and Royal Theatres, Birmingham. Ferranti machines are employed, driving Swan's 123 volt lamps of 20 nominal candle power, but running at about 25 candles each. The light has given great satisfaction, and elicits rounds of applause nightly, being the first exhibition of the high tension lamps in the Midland Counties. The installations were carried out by Mr. T. H. Seymour Hawker, district electrician of the company, and Mr. H. South.

It is stated that the experiment of illuminating the saloon carriages on the South Eastern Railway by electricity will shortly be tried, and that the plan to be adopted is an improvement upon the principle experimented on in the carriages of the Great Northern line.

Our attention has been called to the similarity existing between the Cruto lamp and some forms of incandescence lamps patented by Sir David Salomons. To those of our readers who may feel interested in the matter we give an extract from the latter gentleman's patent, which is dated March 31st, 1882, and numbered 1,580:—"The incandescent substance may consist of carbon powder, or solid carbon enclosed in tubes or other covering of metal, such metal being either a conductor or a non-conductor, the carbon powder or solid carbon may be mixed with any other conducting or non-conducting substance in powder, fibres or otherwise; or the incandescent substance may consist of a tube or any other shaped hollow or solid conducting or non-conducting body, or it may consist of a ball or other shaped piece of wood charred or carbonised; or it may consist of a conductor or non-conductor deposited chemically, electrically, or otherwise, in or on a matrix or form, which may be either a conductor or non-conductor, and which may remain for use or be removed; in the event of the matrix or form being retained in the interior or on the exterior of the incandescent substance, it may require special arrangements for allowing for expansion when the substance upon it is incandescent, such, for instance, as being formed hollow, or hollow and split, and the incandescent substance around such matrix or form may also require to be split or otherwise treated, or to be of larger internal diameter, or of larger volume, than the matrix or form, to allow for expansion and contraction of both itself and the matrix or form."

The Electric Sun Lamp Company.—It is said that all the directors of this company have resigned, and that a new board, composed of only four directors, has been appointed. The business, we hear, is to be reorganised on more economical principles, and the name of

Mr. Paget Higgs is mentioned in connection with the new management of the company. These matters will be brought before the next general meeting of the shareholders, to whom a circular has been issued.

St. George Telephone Company.—We have been requested to ask all persons having claims against this company, to forward without delay, their names and addresses to Mr. H. Alabaster, ELECTRICAL REVIEW Office, 22 Paternoster Row.

Telephonic.—General A. M. Stout, formerly Acting Commissioner of Patents, writing to *The American Artisan*, says, with regard to the question of the telephone patents in America, that the war in the Patent Office (between the American Bell Telephone Company and Messrs. Edison, Gray, Holcomb, Berliner, Dolbear, McDonough, and Richmond) is of such gigantic proportions that it may continue for three or four more years, and that then it may be ultimately transferred to the United States Courts. In the meantime several suits have been brought in the circuit courts of the United States by the Bell Company to enjoin alleged infringements, some of which have been decided in its favour, but no suit has yet been decided in the Supreme Court of the United States, the only tribunal which can settle the question. It is alleged, and, says General Stout, seems to be probably true, that the company is pursuing the policy of settling, privately, with every formidable contestant, either before suit or afterward, and that its great hope of having its claims made good rests upon getting as many circuit court decisions in its favour as possible, in order to induce the Supreme Court to decide in the same way. The writer proceeds to contend that Bell is merely an "improver" of the telephone, and says in conclusion:—"Bell was not the first to discover the sending of signals over long distances by a current of electricity. Morse was. Nor was he the first to discover that speech could be sent by such a current. Philip Reis was. Except his own devices for making use of an undulatory current the writer cannot see what he has invented or discovered. What must become of his broad claims as an 'originator?' Are the people of the United States to continue to pay Bell and his company millions annually because he invented certain specific devices for rendering a current undulatory for the transmission of speech, when Fitch, Berliner, and many others have invented and patented other different devices that answer the purpose just as well, or when Hopkins's devices transmit speech successfully and do not employ an undulatory current at all, but an intermittent one? Are not the pretensions of the Bell Company an immense bubble that needs pricking?—a stupendous fraud that ought no longer to be submitted to?"

The Telephone Case in America.—A dispatch from Washington, of the 15th Dec., says: The arguments by counsel for Voelker and Irwin, Alexander Graham Bell, Thomas A. Edison, Gray and McDonough, parties to the celebrated telephone interference cases which were begun on Tuesday last before the board of examiners-in-chief of the Patent Office, were concluded to-day by Roscoe Conkling. The decision of the examiner of interference was, it will be remembered, in McDonough's favour in what are regarded as some of the most important claims in the telephonic patent. An appeal was made from this decision by Voelker and Irwin, Bell, Edison and Gray to the board of examiners-in-chief, who have spent the past week in listening to arguments by their counsel.

Telephone Patent Litigation in America.—The subjoined statement, dated 12th Dec., says the New York *Electrical World*, now comes from Harrisburg, Pa., with regard to the progress of the suit between the American Bell Telephone Company and the Overland Company:—"A short time since the Bell Telephone Company applied in the Circuit Court of New Jersey at Trenton for a preliminary injunction against the Overland Telephone Company, to restrain the latter from using the Baxter patent, which is said to be an improvement upon the telephones now in use. The Bell Company alleges that the Baxter improvement is to be applied to the Bell telephone, thus making an infringement upon the latter patent. The case was before the court last week, at which time the judge refused to grant the injunction, and gave the Overland Company 10 days' further time to take and present affidavits favourable to its side. The Overland Company, through its attorneys in this city, have been engaged since last Friday in taking affidavits in support of its case. The Overland Company contends that Bell was not entitled to a patent for his telephone, because Daniel Drawbaugh, of Cumberland county, discovered and put into practical operation a telephone long before the time at which Bell avers he invented his telephone. The affidavits taken are mostly those of the persons who were witnesses on behalf of Drawbaugh in the suit pending between the People's and the Bell Companies. The line of argument will probably be that, as Drawbaugh first invented the telephone, Bell was not entitled to a patent upon it, and that consequently, even admitting that the Baxter improvement is to be applied to the Bell telephone, there can be no infringement of Bell's patent, because Bell was not entitled to a patent." It is now reported that negociations are going on between the People's Company and the American Bell Company.

Overhead Wires.—The Postmaster-General has been in correspondence with the Brighton Town Council, complaining of the alleged disadvantage under which the department carries out its works in Brighton, owing to the Corporation insisting on telephone and other wires being carried underground. In one case a lease with the Post Office was determined as it refused to bear the cost of underground works, whilst a telephone company has undertaken the contract with a line said to be carried over-house the entire distance. The Council has informed the Post Office authorities that it is deemed desirable that all telegraph and telephone wires should be laid underground, and that so far as they have legal authority to do so, they insist on that course being adopted.

Sir Charles Dilke was to receive a deputation of owners of property and others respecting overhead wires erected by telegraph and telephone companies, yesterday (Friday), at the offices of the Local Government Board.

Telegraph Service Revenue.—The receipts of the telegraph service from the 1st April, 1883, to 5th January, 1884, were £1,355,000, against £1,315,000 in the corresponding period of the previous year.

North Woolwich Telegraph Works Company, Limited.—We are requested to state that the liquidation of this company in no way affects W. T. Henley's Telegraph Works Company, Limited, which carries on its business at North Woolwich as heretofore.

Charge of Destroying a Telegraph Wire.—The Nottingham borough magistrates had before them, on Tuesday, a case of a somewhat unusual character, Mr. William Henry Truman, of the firm of Messrs. Truman Brothers, wine merchants, Market Place, being charged, under the Malicious Injury to Property Act, with destroying a telegraph wire, the property of the Postmaster-General. In 1881 the postal authorities, having received the necessary consent from the firm, the agreement being signed by the defendant's brother, erected a telegraph wire over Messrs. Truman's premises. In November last this wire was found to have been cut, and, the authorities, communicating with Messrs. Truman on the subject, the defendant admitted that he had cut it. For the defence it was stated that the defendant was ignorant of the existence of any agreement between his firm and the post office authorities, that during a storm which prevailed the vibration of the wire, and those also erected over the building by the National Telephone Company, rendered the chimney unsafe, and that it was on this account that he destroyed the wire. The magistrates pointed out that the defendant had rendered himself liable to a lengthened term of imprisonment, but under the circumstances decided to impose the mitigated penalty of £5 and costs.

The Tonquin Cables.—A Reuter's telegram from Paris, dated January 3rd, states that the vessels conveying the submarine telegraph cables for Cochin China and Tonquin are expected to arrive off Cape St. Jacques about the 4th of February. The cables will be in working order between the 10th and 15th of that month, and will then be connected with Hanoi and Hué.

The Mid-London Electric Railway.—On Friday, the 4th inst., an influential deputation waited upon the Lord Mayor, at the Mansion House, and presented to him a memorial, signed by 160 leading citizens, including 51 members of the Corporation, asking that, having regard to the great injury to the occupiers and inhabitants of some of the principal thoroughfares of the City which the construction of the proposed Mid-London Electric Railway might occasion, his lordship would convene a public meeting of the citizens at an early date, either at the Guildhall or the Mansion House, to consider the nature of such scheme and the desirability of opposing it. Mr. J. W. Billinghurst, vestry clerk of St. Mildred, Poultry, and St. Mary, Colechurch, introduced the deputation, who presented the requisition. The Lord Mayor assented to the request with readiness, stating that he believed the railway was not wanted, and that it would effect much injury to the buildings and the thoroughfares in London under which it would pass. By the desire of the deputation, no date was at present fixed for the meeting, the necessity for which would be obviated if the promoters of the scheme abandoned it by not making the deposit required under the standing orders of the House of Commons. The memorialists thanked the Lord Mayor and retired.

Secondary Battery Patents.—American information is to hand to the effect that in the case of Jablochkoff *v.* Brush, with regard to the secondary battery as applied to the electric light, heard before the Examiner of Interferences, the interference has been dissolved. Brush established by evidence that the device had been in public use for over two years. In the case of Crompton *et al. v.* Brush, also respecting secondary batteries, in which the plaintiffs relied on a foreign patent, a decision has been given in favour of Brush. An application has been refused to extend the time for taking testimony in the cases of Keith, Shaw and Brush *v.* Faure, and Keith, Shaw, Maloney and Brush *v.* Faure.

Barnett's Accumulator.—We believe that the internal resistance of Mr. Barnett's accumulator, which we commented upon in our last week's issue, is $\frac{1}{200}$ of an ohm. Each cell consists of a box measuring externally 1 ft. 10 in. by 7 in. by $6\frac{1}{2}$ in., and divided into sixteen compartments by partitions of porous earthenware. In each compartment a lead plate is placed, and is packed in with finely divided lead. Half the plates, taken alternately, are connected to one terminal and half to the other, and when the battery is formed the expansion of the divided metal, which accompanies its oxidation, compresses it firmly between the porous plates and the lead sheet in its centre, and thus good contact is insured, while all possibility of the active metal falling off is entirely prevented. In the face of porous partitions, and the statement that the accumulator is *practically dry*, the internal resistance appears to be extraordinarily low.

The Late Sir C. W. Siemens.—On Sunday, the 25th of November, 1883, the Rev. J. E. Manning, M.A., preached a most excellent sermon in the Unitarian Church, Swansea, on "The Economic Results of Science and of Theology." The preacher dealt chiefly with the life of the late Sir C. W. Siemens, and the results achieved by his labours. The reverend gentleman said:—"Sir William Siemens is a man whose life illustrates the *sacredness* of science. The expression will, perhaps, sound strange in the ears of those who are accustomed to associate sacredness only with Church theology. But I believe that he who is engaged in developing the resources of nature for the benefit of mankind is engaged in a holy work—quite as sacred as he who devotes his energies to the religious education of the people. There is no distinction between sacred and profane in industry. That only is not sacred which is useless or hurtful. Nothing is profane which proves useful to man by helping him to develop all the resources which God has hidden in nature, *put* there until such time as the needs or genius of man shall bring them to light, and draw forth from them all the wondrous secrets of his providence that lie within them. The scientific man is a revealer. It has taken the world a long time to discover this, and a long time even when it was discovered, to acknowledge it. Nay, even at this day, there are not a few who refuse to acknowledge it, and regard all that the man of science has to say with feelings of suspicion, and his grand disclosures as the wiles of Satan to take captive the mind from an effete and worn-out theology. Such people prefer Genesis to Lyell's Geology, or Lockyer's Astronomy—missing the poetic and mythic beauty of the former, while they know nothing of and care nothing for the truths of the latter. The scientific man is, nevertheless, a revealer of God's truth, a greater revealer than all the theologians from Philo to Calvin. He is, moreover, a greater benefactor of mankind; for the economic results of theology are nothing at all, while those of scientific investigation are innumerable, and have been of incalculable advantage in furthering the social, and therefore the moral, progress of man. Among the great scientific benefactors of mankind Sir William Siemens stands pre-eminent. His scientific knowledge was turned wholly to its practical application, and the fruit of his labour has been no less varied than widely and increasingly useful. He was of all things a practical man."

Obituary.—It is with regret that we have to announce the death of Mr. Wm. Oates, of Alexandria Terrace, Bishophill, who for 29 years had been in the telegraphic service, and for the last 13 years superintendent of the telegraph office in Micklegate, York. The deceased gentleman had for some time been indisposed, but it has been only within the few past weeks that serious consequences were apprehended, and these culminated in death on Sunday evening from rapid consumption, at the age of 42 years.

The French Academy of Sciences.—At the last sitting of the *Académie des Sciences*, M. Maurice Levy was elected by 29 votes against M. Marcel Deprez, who received 24. "We were glad," says *L'Electricité*, "to see the suffrages of the *Académie* given to so distinguished a *savant*, and one so admirably suited, from the nature of his researches, to replace M. Bresse in the mechanical section. But we hope that M. Marcel Deprez's turn will come, and that he will take his place in the physical section."

Royal Society of Edinburgh.—On Monday evening last, Dr. M'Farlane submitted a paper to this society on the arrangement of the metals according to the amount of electricity produced upon them by friction, and showed that the order had relation to other well-known orders. Lord Moncrieff was still too ill to deliver the centenary address, giving a review of the 100 years' history of the society, which he had hoped to deliver at its first meeting in December last.

Institution of Civil Engineers.—The Council has just made arrangements for a series of supplemental meetings for students on Friday evenings during the present month, and one of the papers to be read is entitled, "Some Elementary Electrical Notes," which will be given by Mr. E. Smart, on the evening of February 1st, when Mr. W. H. Preece (member of the Council) is to preside.

Electric Launches.—On the evening of Wednesday, the 16th inst., Mr. A. Reckenzaun will lecture before the members of the Society of Arts on the above subject. The lecturer is well known to our readers, and he is sure to say something of more than ordinary import on such matters. Probably no one has had better opportunities of making himself master of his subject than Mr. Reckenzaun. We are not a little curious to know what remarks he will make on the secondary batteries used in connection with these launches, more especially as the Faure-Sellon-Volckmar accumulators are apparently withdrawn from the market.

An Electric Gunning Punt.—Following up the introduction of Clark's electric launches, which have now been some months in use, says the *Times* of the 10th inst., Messrs. Gilbert Bogle & Co., Glasgow, are now supplying gunning punts fitted up with Clark's patent electric motor and battery. The first boat of this description was built to the order of Mr. John J. Mackie, of Auchencairn, Castle Douglas, principally for wild duck shooting, and also to be carried in his steam yacht, the *Gellert*, for use in the Norwegian fiords and inlets. A trial of this boat took place at Auchencairn on January 4th, Mr. Mackie, Mr. Whitney, and Mr. Clark, the patentee, being present, and proved very satisfactory, a speed of four knots per hour being obtained, while the machinery was noiseless in its action. The punt is 23 ft. long by 4 ft. 6 in. beam, draws 9 in. of water aft, and carries a very powerful gun, weighing about 3 cwt. The propeller, which is two-bladed, gives 500 revolutions per minute when both batteries are in use, and with only one battery a speed of three knots per hour can be obtained.

Lectures on Electricity.—A series of lectures on "Travelling by electricity on Sea and Land," is announced by Mr. Eric S. Bruce, M.A., member of the Society of Arts, whose programme is of a most comprehensive character, and has many novel features. His fixtures are as follows:—St. Leonard's, January 29th; Winchester, February 5th; Bournemouth, February 7th; Windsor, February 11th and 12th; Oxford, February 15th; Southampton Polytechnic Institute (on "Sound and the Telephone") March 5th; Bournemouth National Science Society, early in March, on "The Chemistry of Sea Water."

Illuminants for Lighthouses.—The committee of the Trinity Board appointed to conduct the experiments with illuminants for lighthouses visited Dover on Wednesday, and proceeded to the South Foreland lighthouse to make the final arrangements for the experiments. The committee consisted of Sir Sydney Webb (the Trinity Master of the Trinity House), Captain Nisbet, Captain Weller, Captain Burne, Captain Goyan, Sir James Douglass (engineer to the Corporation), Mr. J. Inglis, and Mr. Price Edwards. After inspecting the machinery and other preparations for experiments, the committee selected ranges inland to the distance of three miles as lines of observation, along which the measurements and relative values of oil, gas, and electricity will be made at night, and especially in thick and foggy weather. The experiments are likely to last for several months, and will be of a very interesting and important character. Three massive wooden towers have been erected along the cliff, in which the experimental lanterns will be placed. One of these will be devoted to electricity, for which some special machinery has been erected; another will be directed to gas, under the care of Mr. Wigham, the exponent of the gas system of lighting as exhibited in the Irish lighthouses; and the Trinity House system of lighting by oil will be experimented upon in the third tower.

Legal.—In the Court of Session, Edinburgh, on Tuesday, Lord M'Laren adjusted issues in an action brought against the North British Railway Company for £300 damages for injuries sustained by the pursuer, Benjamin Wylie, 17, Holyrood Buildings, Edinburgh. It appears that on 10th of August last pursuer was engaged on the Glasgow Union Railway, near Garngad Station, in transferring telegraph wires from old to new poles. He had ascended a ladder which was resting against an old pole, when it gave way. By the fall his right thigh bone was broken, and he was otherwise injured, and taken to the Glasgow Royal Infirmary. Pursuer maintains that the pole was rotten, and had no proper foundation, and holds the defenders responsible. Defenders plead negligence on the part of the pursuer.

The Magnetic Pole.—The following letter was addressed to the editor of the *Glasgow Weekly Herald:*—"Low Row, near Carlisle, *January* 1st, 1884. Sir,—In your last week's Science Notes Professor Thompson is reported to have stated that the present position of the magnetic pole is west, and that formerly it was east from the pole of the earth's axis. These statements are absurd in the extreme. I thought every one knew that every position on the earth's surface is due south from the north pole; and that the magnetic pole is always, and only, due north from places which are south of its position and on the same meridian; and that it is due east or west only from places which are situate in the same latitude. The professor is also reported to have said that 'the same causes which originally magnetised the earth are still at work.' How highly reassuring it is to learn from such an authority that the Eternal is yet in existence.—I am, &c., JAMES DEVLIN. P. T. had better take care!"

St. George, Arthur French, 20, Bucklersbury, London, and Radnor House, Redhill, electrician. A first general meeting of creditors has been summoned to be held at the offices of Messrs. George Davis, Son & Co., 80, Coleman Street, E.C., on the 15th inst., at two p.m.

NEW COMPANY REGISTERED.

General Electric Contract Corporation, Limited.—Capital £50,000, in £5 shares. Objects: To carry on in all branches the business of electricians, mechanical and chemical engineers, and to adopt an agreement, dated 31st ult., between George Robertson Hazewell and Alfred George Rogers, of the one part, and Marius I. Verkeutren (for the company), of the other part. Signatories (with one share each): R. W. Wilson, 30A, Moorgate Street; J. Todd, Manor Park, Essex; D. C. Haldeman, 38, Old Jewry; H. W. Lee, 178, Southgate Road, N.: C. Hascall, 1, St. Swithin's Lane; J. Mason, 1, Pinner's Court, Old Broad Street; W. Fox Homes, 1, Stone Buildings, Lincoln's Inn. Directing qualification 20 ordinary shares; remuneration £500 per annum and one-tenth of all dividends in excess of £10 per cent. per annum. Registered 5th inst., by G. B. Hazewell, 12, Queen Street, E.C.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

Edison's Indian and Colonial Electric Company, Limited.—The annual return of this company, made up to the 28th ult., was filed on the 5th inst. The nominal capital is £250,000, divided into 40,000 A and 10,000 B shares, of £5 each. The number of shares taken up is 29,513. The sum of £2 10s. per share has been called upon 24,513 shares, the remaining 5,000 being issued as paid. The calls paid amount to £56,862 10s., and considered as paid to £25,000. The total amount of calls unpaid is £4,420. This return shows an increased issue of 5,031 shares since the filing of the last return, and also that a call of £1 has been made during the year upon the A shares. Registered office, 4 and 6, Throgmorton Avenue, Throgmorton Street.

CORRESPONDENCE.

Siemens's Electric Power Meter.

With reference to the interesting account of this instrument, contained in your issue for January the 5th, we beg to point out that you will find a complete description of it given in our patent specification, No. 2642, of 1882, entitled "Registering the amount of work given electrically to any part of an electric circuit in a given time," and further that the instrument in question does not measure power at all, but work, and that, therefore, it is known as one form of our "Ergmeter."

Ayrton and Perry.

Telpher House,
73, Great Eastern Street, London,
8th Jannary, 1884.

Telephone Patents.

Having read with interest Mr. W. C. Barney's statement as to patents for telephone receivers, I am sure a similar "*ex cathedra*" opinion as to microphonic transmitters would interest others besides myself.

"Delta."

Jan. 5th, 1884.

The Theory of the Gramme and "Unipolar" Dynamo Machines.

During the past year numerous articles have appeared in the ELECTRICAL REVIEW on the theory of continuous-current dynamo machines, many of which show that there are still some scientists who fail to perceive the absurdity of considering the interior wires of the Gramme ring as merely so much useless resistance. Even Dr. St. Doubrava (see ELECTRICAL REVIEW for October 6th) says :—"The whole internal length of wire as it is not traversed by any electromotively active line of force is merely conductive ballast, in which electric energy is transformed into heat."

In the otherwise admirable treatise on "Electric Illumination," published by your contemporary *Engineering*, the same fallacy is constantly repeated.

Mr. Cunynghame in his article on the theory of the Gramme ring, says that the interior wire is not idle ; but, like Antoine Breguet, says that it is cut by the lines of force which curl around into the interior of the ring. Now, if the inside wire is useless or thereabouts, how is it that the machines of Schukert, Fein, Jurgensen, Krizik, Heinrichs, *et genus omnes*, are not more efficient than the ordinary Gramme ?

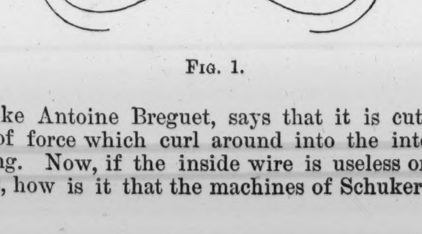


FIG. 1.

In fig. 1 is shown a Gramme ring and inducing poles in section ; fig. 2 shows the same in plan. The lines of force are supposed to flow from the N. to the S. poles, the direction being shown by the arrow heads.

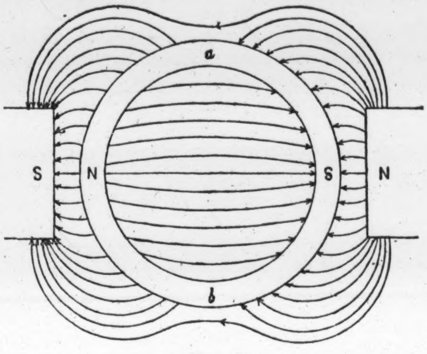


FIG. 2.

It will be seen on reference to fig. 2, that a coil of wire passing from *a* to *b* in the direction of the large arrow, would cut lines of force flowing from the N. pole of the ring to the S. poles on each side of it ; conversely, in passing from *b* to *a* in the same direction, it would cut lines of force flowing into the S. pole of the ring, not only from the N. pole of the inducing magnet, but from the N. pole on the other side of the armature.

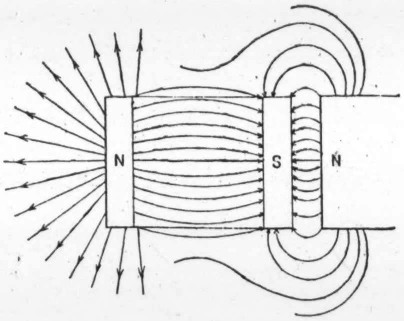


FIG. 3.

A section of the "unipolar inductor" machine is represented in fig. 3, which shows that the directions taken by the lines of force are the same whether the armature is influenced by one pole or by two.

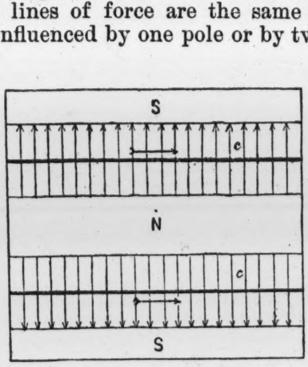


FIG. 4.

Fig. 4 is a longitudinal and fig. 5 a transverse section of the armature of a "a unipolar induction" machine, such as those of Siemens and Halske, Ferraris, and Floyd-Delafield ; S is a tubular magnetic pole in the interior of which is the other pole, N, in the form of a solid cylinder ; between the two is placed a copper tube, C, forming the armature, when this is rotated it cuts the lines of force passing between the poles, and currents are induced in the direction shown by the arrow in fig. 4.

I consider that these diagrams prove that the interior wire of the Gramme ring is as useful as the exterior, and therefore that the advantages obtained by the use of flat rings, interior electro-magnets, and encircling poles are, to say the least, microscopical. They also show the immense differences existing between the "unipolar inductor" and the "unipolar induction" machines, although Mr. Cunynghame seems to have mixed them together in his letter of the 8th of September.

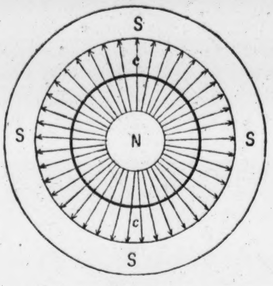


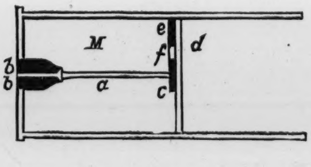
FIG. 5.

F. de Wolffers fils.

Clapham,
Jan. 1*st*, 1884.

Electrical Guns.

I noticed in the last number of *Engineering* a description of an electrical gun, the device of Herr Pieper. This is given below, and I forward the sketch illustrating the same if you think it of sufficient interest to reproduce. My sole reason for asking a small space in your columns is for the purpose of briefly describing a device of my own, which I think you will acknowledge is more simple than that of Herr Pieper, being self-contained. First, however, the description of that gentleman's apparatus. It is an ordinary rifle in which explosion is produced by heating a platinum spiral. The source of electricity is a little accumulator weighing about 5 oz., and which is carried in the belt. One pole is in connection with a metallic glove which the user wears on the left hand, and the other with a metallic shoulder strip; the accumulator has sufficient energy to fire 10,000 rounds. When the gun is brought to the shoulder the circuit is almost complete; to close it, it is necessary to proceed as follows. The diagram shows a section of the cartridge; M is the powder chamber, the axis of which is occupied by the copper rod which bears on the bottom plate, but from which it is separated by a small ebonite piece, *b*. The rod, *a*, presses on the brass button, *c*, of the disc, *d*. Close to this is a platinum wire, *f*, $\frac{1}{10}$ mill, in diameter connected on one side to the button, *c*, and on the other to the strip, *e*, attached to the cartridge shell. The firing pin when pressed against the end of the rod, *a*, closes the circuit, the platinum wire is heated, and the charge exploded. The cartridge I had proposed to employ was of a somewhat simpler construction than that of Herr Pieper, inasmuch as the platinum wire was arranged at the rear of the powder chamber, so that the powder ignited at the same place as is the case with an ordinary pin or central-fire cartridge. Instead of using an accumulator as the source of electrical supply, I wished to employ a bichromate or other suitable battery, fitted into the stock of the gun in such a manner that when the gun was held muzzle downwards, or as carried under the arm, the liquid of the battery should not be in contact with the electrodes. When raised to the shoulder the battery was in working condition. I need not specify the simple means which can be devised for firing. *Engineering* says, in commenting on Herr Pieper's invention:—"It can scarcely be claimed that this device has any real value, but it indicates possibly one direction that future inventions in reference to fire-arms may take." Although the arrangement I have here shadowed forth has been in my thoughts for a long time past, I did not consider that the time had yet come for such applications of electricity, and it was only the notice of Herr Pieper's gun which suddenly recalled to my mind my almost forgotten suggestions. I see no reasons why electrical guns and rifles may not be successfully employed. It would save the present expensive lock mechanism, and these guns might certainly be made in such a way as to afford less risk of accidental explosion, and therefore greater safety to sportsmen and others.



Petronel.

January 7*th*, 1884.

Bichromate Batteries.

I shall be much obliged if some of your numerous readers will advise me under the following circumstances: I have a ten cell bichromate battery with one carbon plate between two zinc plates; the carbon plates have brass caps fixed on the top to which the wires are connected; to ensure a connection between the carbon and the cap the space was run in with lead. This battery has been in work for several years, great care being taken to have the zinc plates properly amalgamated, and a fresh solution when required, but notwithstanding all this care it refuses to work at the present time. I have taken out the lead that was used in making good the connection between the cap and the carbon, and put in fresh lead, thoroughly scraping the carbon before doing this, but still without avail. Trusting you will be able to assist me.

F. T.

January 6*th*, 1884,

The Patent Act, 1883, Trade Marks Section.

I trust you will pardon my intrusion on your valuable space, but I have to-day received a letter from the Trade Mark Office of great importance to applicants for trade mark registration who have recently been refused on the ground that their application, though not identical with, *appears* to resemble a prior mark.

The letter is as follows:—

"Patent Office, Trade Marks Branch,
"25, Southampton Buildings,
"Corr. 5,912. "London, 5*th January*, 1884.

"Gentlemen,—I am directed to acknowledge the receipt of your letter of the 2nd instant, and in reply to say it would appear that in the case of a proposed trade mark refused under the old Act, and where the applicant does not propose to seek the leave of the Court for its registration, the best course would be, as you suggest, to raise the question again if desired, by making a fresh application under the new Act and the rules thereunder.

"I am, gentlemen,
"Your obedient servant,
"(Signed) W. J. F. TOMLINSON.
"Messrs. Popplewell, Colton & Co."

The importance of the above to many lately refused applicants suffering through refusal, is my excuse for sending the above.

E. Gardner Colton, A.S.T.E., &c.,
Fellow of the Institute of Patent Agents
18, Southampton Buildings, W.C.,
January 7*th*, 1884.

NEW PATENTS—1884.

280. "Galvanic batteries and arrangements in connection with them." J. Enright. Dated January 2.

282. "Generating electric currents by means of statical electro-magnets and armatures." W. Aldred. Dated January 2.

314. "Dynamo-electric machines." S. Williams. Dated January 2.

331. "Dynamo-electrical machines." J. H. Johnson. (Communicated by E. C. Barton.) Dated January 2.

339. "Telephone transmitters." H. J. Allison. (Communicated by D. Drawbaugh.) Dated January 2.

345. "Improvements in tram-cars, railway-cars, and other vehicles, and the method of taking up and setting down passengers in the same, while running on rail or road, and driven by horses, steam, electricity, gas, traction rope, or any other power, and the manufacture thereof." C. L. H. Lammers. Dated January 2.

395. "Tubular electric conductors." B. Finch. Dated January 2.

409. "Electric lamps." S. H. Emmens, R. Barlow. Dated January 2.

411. "Holder for electric lamps." R. Barlow. Dated January 2.

412. "Electrodes for galvanic cells." S. H. Emmens, R. Barlow. Dated January 2.

449. "Electric arc lamps." J. H. Greenhill. Dated January 2.

450. "Electric arc lamps." J. H. Greenhill. Dated January 2.

464. "Telephonic apparatus." S. Vyle. Dated January 2.

557. "Insulated wires for coils of electrical apparatus." A. Millar. Dated January 3.

572. "Armatures of dynamo machines." C. F. Cooper. Dated January 3.

595. "Means for facilitating communication and electric lighting in railway trains." T. J. Mortin. Dated January 3.

613. "Electro-dynamic or dynamo-electric machines." G. Scarlett. Dated January 4.

718. "Voltaic batteries." W. P. Thompson. (Communicated by E. E. Senet.) Dated January 5.

722. "Securing bundles of letters, parcels, or newspapers without tying a knot, named electric clip." J. Carter, T. Trotman. Dated January 5.

742. "Galvanic batteries for medical purposes." H. C. Blackwell. Dated January 5.

743. "An electric arc lamp which will be called the eclipse arc lamp." J. Matthews, T. Vann. Dated January 5.

748. "Protecting underground electric wires." H. H. Slade, W. A. Slade. Dated January 5.

768. "Dynamo-electric machines." J. Hopkinson, W. Mather. Dated January 5.

770. "Dynamo-electric machines, and method of constructing the armatures therefor." T. Parker, P. P. Elwell. Dated January 5.

806. "Electric safety lamps." T. Coad. Dated January 5.

828. "Weighing by electricity." G. C. Browning. Dated January 7.

839. "Electric motors." S. P. Thompson. Dated January 7. *Complete.*

898. "Arc lamps." J. Brockie. Dated January 7.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1883.

1956. "Telegraphic apparatus." E. J. Houghton. Dated April 18. 6d. Relates to the apparatus described in the present number of the Review, page 23.

2028. "Apparatus and processes for generating, regulating and measuring electric currents." Sir William Thomson. Dated April 21. 3s. 2d. Relates to the apparatus described in the number of the Review for January 5th, and also to apparatus and processes for regulating and measuring electric currents.

2148. "Generation, storage, regulation, distribution, measurement, and utilisation of electricity and apparatus therefor, &c." J. S. Williams. Dated April 27. 10d. Consists in improvements in and relating to the generation, storage, regulation, distribution, measurement and utilisation of electricity, and in apparatus, methods, or means therefor, and in apparatus, devices, or means employed in the construction or working of an apparatus or system of electrical distribution, and the said invention relates partly to methods and means for utilising the generating apparatus to their full capacity, or so as to provide for utilising a surplus of power or heat at gas works, manufacturing establishments, or elsewhere, or devices or means for converting natural forces into power, and utilising such power or surplus of such power by its conversion into electric energy, and the storage of such energy or any surplus of energy capable of being developed either of high or low potential in the electric circuits of energy capable of being produced by the generating devices or apparatus over what would be required in an electrical system of distribution.

2195. "Electric ways or conductors." B. J. B. Mills. (Communicated from abroad by E. M. Bentley and W. H. Knight, of America.) Dated May 1. 10d. Consists in the arrangement of electric conductors, running in proximity to one another, whereby conductors carrying different classes of currents, as electric light, telegraph and telephone wires, may be undisturbed by mutual induction.

2304. "Automatic regulation at a distance, of electric currents, &c." E. G. Brewer. (Communicated from abroad by La Société Anonyme des Ateliers de Construction Mecanique and d'Appareils Electriques, of Paris.) Dated May 7. 4d. Relates:—1st. An arrangement of two special regulating valves. 2nd. A system of electro-magnets governing one or other of the two valves according as the delivery of the current is too strong or too weak. (These two groups or organs are situate in the immediate neighbourhood of the central machine.) 3rd. A testing apparatus of varying form, situated at the end of the circuit, from which it derives a portion of its energy to transform it into an indicated electric current, or of such intensity that it operates by the intervention of a special conducting wire, the electro-magnets regulating the valves. (*Provisional only.*)

2358. "Secondary voltaic batteries." A. Partz. Dated May 9. 2d. The first part of the invention relates to an electrode, which will not become disintegrated, and does not require to be protected by a cover of woven or felted material. The electrode is composed of carbon and lead, in such a way that the latter is embodied or encased in the former, so as to be secured against becoming detached, without being rendered inaccessible to the electrolyte. The carbon must be porous or perforated, or both, and is accordingly either impregnated, or otherwise intimately combined with oxidized or finely divided lead, or its perforations are filled therewith, while to the same purpose two permanently united plates of such carbon may be made to enclose a layer of such lead. The second part of the invention is intended to render the strength and continuance of secondary currents independent of changes in the state of the anodes. It consists in the combination with an electrode made substantially as, and in either of the forms herein above described, when used as a cathode, of an anode of amalgamated zinc, that is to say of a metal which dissolves in the electrolyte and the potential of which therefore remains constant. (*Provisional only.*)

2373. "Insulating supports for telegraph and telephone wires." S. Woolf. Dated May 9. 2d. Consists in the construction of an earthenware sheath with supporting arms, projections or brackets also of earthenware moulded in one therewith to carry the wires. This sheath is closed at top and may be of such dimensions as to closely envelop the upper part of the pole, or any greater portion ot its length, the sheath being in the latter case either in one length or built up of two or more tubular sections. The arms, projections, or brackets for the support of the wires are of such form and dimensions as to adapt them to withstand the strains to which they may be subjected by the wires. These arms, projections, or brackets may be grooved with oblique undercut grooves, and the wires may be bound to them in the same way as they are now bound to ordinary insulators, or the arms may be otherwise grooved, or they may have slots or notches moulded or formed in them of such form that the wires may be slipped laterally into said slots or notches, but cannot escape therefrom, or the projections, arms, or brackets may be perforated, and the wires be threaded through them. (*Provisional only.*)

2390. "Obtaining gold, silver, copper and other metals from their ores by electrolytic action, &c." C. D. Abel. (Communicated from abroad by Michael Body, of Liége.) Dated May 10. 6d. This invention relates, firstly, to the preparation of ores that are to be subjected to electrolytic action, and, secondly, to lixiviating and electrolytic processes. The ore, placed in a heap, is first wetted and then left to the action of the atmospheric air, being turned over repeatedly. The wetting may be effected with the acids of spent baths. The ore can then be subjected to a rapid roasting process, in order to complete the preparation, such roasting being effected in muffle or reverberatory furnaces, with condensing chambers, which are so useful for the production of the necessary acids. In this case the ore is afterwards again reduced to powder. After the ore has been prepared as above described, the electrolytic process is applied thereto, either while it is in heaps or in receptacles. In both cases, the surface on which the ore rests must consist of compressed carbon or of a metal plate to which the negative pole of an electric machine is connected, while the other pole is connected to one or more points of the ore. During the treatment, the passage of the electric current through the heap of ore effects the more perfect solution, the stronger the current and the more limited its duration. During the latter part of the separation, therefore, the action of the current may be discontinued. In operating in receptacles, the solution of the metal is facilitated by stirring.

2434. "Producing, distributing and utilising electricity for lighting, motive power, &c." E. L. Voice. Dated May 15. 6d. A number of electro-magnets are mounted on a shaft, whose poles are alternately arranged, thereby forming an armature capable of rotating. A number of stationary electro-magnets, whose poles are also alternately arranged, are so placed as to allow the rotating magnets or armature to revolve in close proximity to the said stationary magnets. This machine or apparatus is placed in a circuit electrically supplied by dynamo-electric machines, batteries, or other suitable generators. Intermediate between this apparatus, or "motor-inductor," and the electric generator, a cross wire or shunt-conductor forming the consumption circuit, is joined to the flow and return wire of the main circuit. The electrical resistance of the consumption circuit is governed by the number of lamps or the nature of apparatus to be electrically acted upon. By a suitable commutator, or other mechanical device, the whole of the magnets are periodically demagnetised, and the polarity of one or other set of magnets is reversed each time the main circuit is closed. The action is as follows:—The commutator closes the main circuit, causing the armature poles to face like stationary poles; the movable poles are consequently repelled from this position and place themselves so that a S armature pole faces a N stationary pole; the commutator then opens the circuit, and the demagnetisation produces an induced current which traverses the consumption circuit. The circuit is again closed, and so on.

CITY NOTES, REPORTS, MEETINGS, &c.

South African "Brush" Electric Light and Power Company, Limited.

AN extraordinary general meeting of this company, was held at the City Terminus Hotel, Cannon Street, on Friday, the 4th inst., Lieut-Col. Coxon, Chairman, presiding, for the purpose of considering a proposal to reduce the capital of the company.

The Secretary (Mr. T. J. Seel), read the notice convening the meeting, in which was set forth the following resolution, to be submitted to the shareholders:—"That the capital of the company be reduced from £100,000 to £60,000, and that the 20,000 shares already issued, and constituting the present capital of the company, be reduced from £5 each to £3."

The Chairman said: In proposing this resolution I must apologise for a mistake. You will remember that at the last meeting we were asked, whether at this meeting a resolution could be proposed as an amendment to ours, such amendment being embodied in a communication from the Rev. Mr. Johnson. I don't think we stated distinctly that it would be competent for Mr. Johnson or any other shareholder to do this; in fact, I refrained from making any such statement as far as I, myself, was concerned. But I freely admit my conviction that the meeting broke up with the idea that an amendment could be proposed to our resolution at this meeting. I am sorry to say now that that cannot be done. This meeting can only deal with the resolution which has been read. With regard to any subsequent steps shareholders may take, we are entirely in their hands, so far as calling them together, should they wish us to do so. In the meantime, the hard line of the law forbids our going beyond the subject we have given you notice of. Those of you who were present at our last meeting, will remember all we had to say upon the subject of the present position of the company, and those who were not present received a careful verbatim report of the proceedings through the papers, which we took care to send to all who were not present. It is therefore perfectly unnecessary for me to go into that question any more, It might not be out of place for me, however, to tell you that, since our last meeting, matters have looked somewhat better; at least I will leave you to judge of that, and will simply tell you that our last letters from our manager are more hopeful. He has had a reminder, or a request, from the Dock Corporation at Cape Town, whose contract with us has lapsed, to propose another contract; in fact, they have pressed him to form with them another contract. I think the reason why they have delayed hitherto, is that they were anxious—in fact, we know that that was the case—to wait a little before a fresh contract was made, hoping that from the favour with which the light was looked on in Cape Town, we should get more business in the town, and therefore be in a position to offer them more favourable terms. That is the only reason they have not pressed us before, and they now press us to renew the contract. That settles the question of the popularity and efficiency of the light in Cape Town. Mr. Atkinson (a director), who is at present at Kimberley, and who is a shrewd business man, and a holder of 900 shares in this company, writes from that town, and speaks of the light there as better than any he has seen in England. I think that will speak for itself as to the efficiency of our officers in Kimberley. We have a circuit of seven miles there, with 32 efficient "Brush" lights, worked by one dynamo machine; that I think settles another question, raised by a gentleman at the last meeting, who said, "The Brush system is obsolete." The "Brush" system is not to be touched. (Hear, hear.) A committee sitting at this moment in London, consisting of eminent engineers, electrical and otherwise, have emphatically asserted that nothing can ever beat the "Brush" dynamo. (Hear, hear, and No, no.) Anyhow we have a proof of what it can do in the wilds of South Africa. I merely tell you these things as facts more or less encouraging, and that will perhaps influence you one way or the other; they may show the way the wind blows. We have had a letter of application from the Anglo-American "Brush" Company, otherwise the "father" "Brush" company, for permission to ship, without further redtapeism, on the 24th inst., the whole electrical plant and machinery required for the Lisbon-Berlin Gold Mining Company in the Transvaal. We hold the concessions for the whole of Cape Colony and the Transvaal, and we thought it expedient under the circumstances, when application was made to us for permission to enter into a contract with the Berlin company, to grant that permission. That transaction is not much in itself, but it points to this: if these goldfields are a great success—I know there are strong opinions as to this—but if they are, and a powerful company like this Berlin company works night and day, which they intend to do by getting the light, it is fair to judge all other companies will do the same. Suppose they do not, at all events there is an extension of the light in that direction, and if it goes no further, it even then rather strengthens our plea for continuing that work, from the fact that they are in the Transvaal, and should we hold on and bide for better times, we should then have a field, should we finally decide to wind up, for our Kimberley plant. We have about from £5,000 to £7,000 worth of plant in Kimberley, and should we wind up the company that is only worth its weight as old iron. If we do but bide our time we can get our price for it. The Transvaal gold fields are about 100 miles from Kimberley. I now beg to move the resolution.

A Shareholder asked if Mr. Atkinson's shares were fully paid.

Mr. Dickson (a director): There are no fully paid shares; they are all in the same category.

Mr. Dickson, in seconding the resolution, said the board simply wanted a small unpaid capital left, so that they might be able to meet an emergency when it occurred. They were holding their own very well indeed, and, as they had gathered from a statement by their very efficient secretary, they had money in the bank, and were able to pay their way. The directors would take care of the affairs of the company, for they were large shareholders themselves, and they would not call up 10s. unless they saw a very good way of utilising it. The colony at the Cape, as well as many other colonies, had been passing through a period of great depression, and that depression has re-acted on electric lighting; but the fact alluded to by the chairman, of the gold mining operations, was a point likely to turn to their advantage. Nothing could be more efficient for the purposes required than such a light as the "Brush," and it would be very unwise to leave the field when by reducing capital they would be able to go on to the benefit of the company.

The Rev. H. J. Johnson: Do I understand that we can only say "Yes" or "No" to this matter?

The Solicitor to the company replied that such was the case.

Mr. John Taylor said in that event the representative of the company's solicitors who was present at the last meeting, was distinctly to blame for allowing shareholders to depart with a wrong impression.

The Solicitor said it was a question on which a great deal of difference of opinion existed, and contrary opinions were urged, but the authority on the subject was clear, and did not bear out the latter contentions.

Mr. Taylor remarked that had he known that would be the position he would never have agreed to the passing of the report and accounts, and should have moved the adjournment of the previous meeting.

A Shareholder asked, in the event of a majority voting against the resolution, would the board propose a further reduction?

The Chairman: Most certainly; and what is more, we would invite a committee of shareholders to draw up the resolution.

Mr. Clodd said it was the general feeling at the last meeting that no further liability should be incurred; and he thought the straightforward course would be to wind up as soon as possible what was confessedly a miserable failure. ("No, no!")

The Rev. H. J. Johnson stated that he had taken a barrister's opinion on the question of whether it was competent for an amendment to be submitted, and he was of opinion that an amendment such as he desired to move, and of which he had given notice, might be put; that being so, he (Mr. Johnson) thought shareholders were entitled to say distinctly and formally, that should their interests suffer by the chairman refusing to put the amendment, they would hold him legally responsible for any loss which might thereby be sustained. (Laughter.) The rev. gentleman then read an extract from a treatise on the Companies' Act, which, he said, was by the chief legal authority on the question. The extract read as follows:—"In the absence of any such (specified) regulations it is conceived that it would be competent to a meeting to entertain and vote upon any amendment pertinent to the subject matter of the resolution of which notice has been given." In order to prevent any possible technical objections being raised, and in strict fulfilment of the articles of association, he had sent in a copy of his amendment on the previous Friday. If the amendment was one which could not be put, why did not the secretary inform him of the fact, and thus have spared him the trouble of coming from Liverpool on purpose to attend that meeting? (Hear, hear.) His amendment was, "That the capital of the company be reduced to £2 5s."

Mr. Harvey took exception to the statement made by the chairman with reference to the more favourable prospects at the Cape in consequence of the gold mining operations.

The Chairman said he did not allude to the subject with the purpose Mr. Harvey seemed to imagine; he did not mention it as encouraging a brilliant prospect for the use of their light, but to point out that they might, and probably would, if the gold fields were successful, find a field later on for the disposal of their Kimberley plant, should they give up the contract at Kimberley.

Mr. Harvey submitted it as his impression that the gold fields would turn out a myth; and he hoped the directors would not be led away by the "almost certain" hope of very successful gold mines in the Transvaal; they probably would be successful to certain persons, but to those persons only, and the statement should not go forth to the shareholders who were not present that better prospects had opened up in consequence of the operations mentioned. The board had a certain amount of money in hand; their future revenue was altogether doubtful, whilst their expenditure was altogether certain. Therefore, looking at the matter as a business man, and as a colonist of some experience, he would advise them to accept the 10s. per share, which they were well able to pay.

The Rev. H. J. Johnson then moved his amendment, that the capital of the company be reduced to £2 5s., and stated that he found from the balance sheet that there was money enough to pay back to the shareholders 5s. per share, leaving 5s. to work with. He understood the company was paying its way; was that so?

The Chairman: Yes.

The Secretary: Approximately.

Mr. Johnson: Approximately may mean anything.

The Chairman: In the absence of exhaustive figures, we may fairly be said to be paying our way. We may be a little on the wrong side, or a little on the right.

The Secretary then read a statement showing the financial position of the company, previously stating that the returns from the Cape were only up to the 31st of October last. From this statement it appeared that the company now had a sum of £5,600 in cash, and £4,000 debts, besides assets in the shape of machinery and stock, to the extent of nearly another £1,000.

Mr. R. E. Tomkinson then seconded the amendment, but the chairman said he was precluded by law from putting it.

Mr. Dickson pointed out that the question at issue really rested with the shareholders themselves; as, if they rejected the resolution, another meeting would be called to carry out the views which had been expressed. Mr. Johnson had appealed to the shareholders, and so had the directors, and a poll would show whose views were to prevail.

The resolution was then put and lost by a large majority, only two or three holding up their hands in favour of it.

The Chairman demanded a poll, which was at once opened, and kept open at the company's offices until Tuesday afternoon, the result being:—For the resolution, 512; against, 579; majority against, 67. 90 votes were recorded in favour of the resolution after the closing of the poll.

The Mediterranean Extension Telegraph Company, Limited.

AN extraordinary general meeting of this company was held at the Cannon Street Hotel on Wednesday, the Hon. Ashley Ponsonby presiding, for the purpose of considering an agreement between the liquidators of the company, and the Eastern Telegraph Company, for the sale and purchase of the company's property.

The Secretary (Mr. Tombs), having read the notice convening the meeting,

Mr. Campbell gave a brief statement of the provisions of the agreement, which he said was for the sale of the submarine cables, machinery, offices, buildings, lines, instruments, plants, fixtures, and other appliances and appurtenances; also two concessions, one obtained in May 1859, the other in July 1861, and all the rights and liabilities attached to those concessions. The proposed price was £35,000, in the 4 per cent. debenture stock of the Eastern Company, to be taken at par. From the completion of the purchase, the Eastern Company undertook to perform all the stipulations and obligations required by the concessions, and to keep this company indemnified from the same. This company declared, according to the agreement, that they had done all that was necessary under the terms of the concessions, and that they had power to sell and assign the property to the Eastern Company. The time fixed for the completion of the purchase was March 1st, 1884, and the agreement was subject to the approval of the shareholders at a general meeting held for the purpose before the 15th January, and also subject to the consent of the Italian government. There was a proviso that, should the shareholders not approve or the Italian government withhold its consent, then either the liquidators of this company or the Eastern Company had power to put an end to the agreement on giving one month's notice in writing.

The Chairman then moved: "That the provisional agreement between the liquidators of this company and the Eastern Telegraph Company, for the sale and purchase of this company's submarine lines, concessions and other property having been read to the meeting, it is resolved that this meeting do approve of the same, and authorise the liquidators of this company to take the necessary steps to carry the same into effect as soon as possible." In doing so he said he would tell the shareholders how the liquidators (Mr. Griffiths and himself) came to the opinion that it was better to sell the company. They must remember that about a year ago they came to the conclusion that they would not accept the £40,000 that was offered by the Eastern Company under certain conditions. The late Sir James Carmichael, their chairman at the time, and he (the present chairman) expressed their views as shareholders, and not as directors, that it was best not to accept that offer; they had rather more than an idea that they would be able to sell the company for a better sum to other parties. That had fallen through. They had no tangible offer from those parties, nor any means of ascertaining what they would give. The Trieste cable was laid down by the Eastern Company, and this attacked their earnings and they were in the position of being between hostile companies. The consequence was, considering that their concessions were getting shorter and their cables older, they thought it would be advisable to again enter into negociations with the Eastern Company. They (the liquidators) had very long and earnest consultations with the chairman and the solicitors of the Eastern Company, and they were able to get no better terms than those set forth in the agreement. They must remember also that they were a great deal crippled by a petition for liquidation. They were not in a position to pay their shareholders any dividend; if they paid the preference holders, nothing would be left for the ordinary holders; and upon those grounds they came to the conclusion that it would be better not to fight that petition if it went into actual court, but to try to sell the company for the most they could get. They had a tangible offer, and it was for the shareholders to decide whether they would accept it or not. They were met simply to say "aye" or "no," and the question of the division of the assets must be left for future decision. They would have to go before the courts to get the agreement ratified, if approved by the shareholders, and if the matter were unduly delayed they would probably lose their chance of sale, and prolong the risk in regard to the cables.

Mr. Griffiths seconded the resolution.

Mr. Gould, chairman of the committee of preference shareholders, thought some means should have been taken to put the shareholders in possession more fully of the terms of the agreement. He was not going to say that £35,000 was not a fair sum, but the agreement was a document of such importance, that the shareholders should have time to study it. He asked that he might be allowed to read it. Although he had said he did not consider the sum offered, under all circumstances, an unfair one, yet he should have liked the offer better, and would say "aye" to the resolution far more readily, if the Eastern Company had offered that sum on what they had the ability to give, and not on what they would have to pay a certain sum to get. If the offer was 5 per cent. debentures instead of 4 per cent. he would most heartily have accepted it, with the greatest thanks to the liquidators for what they had done. They should consider that that sum, in the way offered did not represent £35,000; the 5 per cent. of the Eastern Company's debentures was about par, and the 4 per cent. about 80.

Mr. Griffiths: It is 95 in the market.

Mr. Gould: I am glad to hear it, and it brings me much nearer to an agreement.

Mr. Griffiths: The 5 per cents. are redeemable debentures in a very short time; the 4 per cent. stock is permanent, and is being sold at 95.

Mr. Campbell said, in reply to a question, that this company would work on its own liability up to the time of the sale.

A Shareholder pointed out the necessity for as little delay as possible, remarking that a break of the cable might occur at any time, and that would necessitate the expenditure of a considerable portion of the reserve fund.

Mr. Griffiths, replying to a question, said the reserve fund, which, with the undivided assets, amounted to nearly £15,000, would not be affected by the sale.

Mr. Cuthbert enquired if negociations had been entirely confined to the Eastern Company, and whether any French or Italian companies had been communicated with. He thought possibly better terms might have been arrived at with some other company. The agreement had to receive the assent of the Italian Government, and therefore it was advisable to obtain the assistance of people who would have some weight with the Government.

Mr. Campbell: I think the people most powerful in the Mediterranean would have most weight with the Italian Government.

The Chairman said it was known that the company was for sale, and a suggestion had been received from Italy, which did not amount to an offer, and which they could not accept.

The Solicitor to the chairman of the committee of preference holders, having read the agreement, said there was nothing in it to which he could object; and he might say that the preference shareholders considered the price offered an adequate one.

A Shareholder asked how soon the agreement would be binding.

Mr. Campbell said it would be binding on them as soon as they passed the resolution, and the seal of the Eastern Company would be affixed in a few days; the latter company had already approved it.

The resolution was then put and carried unanimously.

Mr. Hurst asked if the liquidators were going to make any arrangement on behalf of the officers of the company.

Mr. Griffiths said some of the older officers, the superintendent at Malta, the secretary, the accountant, and others, would not be taken over by the Eastern Company. These had given the company many years' excellent service, and he thought some compensation should be given to them. Fortunately the means could be found without taking anything from the company. In examining the accounts he had found that for some years a fund had been accumulated for money paid in excess of the ordinary rate, and which had been unclaimed. When they came to wind up a proposition would be made to give the servants of the company some compensation, and to take it from this fund. (Hear, hear.)

Mr. Cuthbert said he thought the proposition made one of a most extraordinary character. Did any one present know of any trustees in bankruptcy ever awarding the servants of an insolvent firm or company compensation for past services and loss of employment? He sympathised with them as an individual, but he did not see how a person in the employ of a company almost on the verge of insolvency could expect any such compensation. The shareholders were, without doubt, more entitled to that money than the servants of the company.

Mr. Griffiths stated that the amount of this fund was about £1,900, and was included in the balance-sheet in the liabilities of the company. The proposition would come before them at a future time, and it was of no use to discuss it further.

The meeting then separated.

The Maxim-Weston Electric Company, Limited.

THE board of this company report for the past three months, ending 31st December, 1883, as follows:—

The net profits (estimated, as a number of the contracts are not yet completed) from sales for the three months exceed £1,500, after deducting working expenses. Tenders have been sent out for over £22,000 value of plant, with every probability that a good share of contracts still unfixed will be secured by the company.

Messrs. H. S. King & Co., bankers, &c., Cornhill, E.C., have been appointed Indian agents for the company, and equally influential agents have been appointed for the colonies.

The company are now executing a second contract with the Agent-General for one of the colonies, the Government there having adopted the Weston system in one of their departments, and negociations are pending for the adoption of both our arc and incandescent systems on a large scale. Further influential agencies have been established at home, and everywhere our installations are an unqualified success. Two contracts, the largest ever granted to any company, are promised as soon as the extra steam power has been established. Important negociations are in process, calculated materially to increase both the annual revenue and also the available working capital of the company.

The self-regulating Weston dynamo for incandescent lighting will compare favourably with any dynamo now in the market where the turning off and on of the lights individually are a necessity. The new 8 and 16 candle-power lamps have given great satisfaction, and combine economy and durability in a remarkable degree.

The self-regulating dynamo and small lamps have now enabled the management to enter the lists as competitors in the important department of lighting of steamers, and already a trial contract to light one of the largest steamers afloat has been secured, which may open up a most lucrative source of revenue.

The great strides in improvements made by the American Company, and moderate tariff this company have now secured from them, render us in a position to undertake lighting of every description, and compete successfully in prices against the few remaining really operative companies. The directors have also given considerable time and attention to the application of their dynamos for other purposes second only in magnitude to lighting, foremost among which is for motive purposes, for which the Weston dynamo has proved exceptionally suitable.

The directors (who hold about 20,000 shares in the company) consider that, in view of all the facts, they are entitled to assert that the company is rapidly securing a leading position in lighting.

The Yorkshire Brush Electric Light and Power Company, Limited.—At an extraordinary general meeting of this company, held at the Cannon Street Hotel, on the 27th ult., the resolutions previously passed to wind up the company, and appointing Mr. Philip A. Latham to act as liquidator, and to carry out the agreement to amalgamate with the Hammond Electric Light and Power Supply Company, Limited, were confirmed.

The Birmingham and Warwickshire Brush Electric Light and Power Company, Limited.—The resolutions to wind up this company, and appointing Mr. Philip A. Latham to act as liquidator, and to carry out the agreement to amalgamate with the Hammond Electric Light and Power Supply Company, Limited, were duly confirmed at an extraordinary general meeting held for the purpose, at the Cannon Street Hotel, on the 22nd ult.

Re C. G. E. Terraneau.—This bankrupt, who is described as of Bucklersbury, promoter of public companies, was recently adjudicated, and the first meeting for the proof of debt and choice of a trustee of the estate took place on Wednesday, when the bankrupt was in attendance, but produced no accounts. Proofs to a small amount were put in, and two trustees and a committee of inspection were appointed.

Ferranti, Thompson, & Ince, Limited.—It has been resolved to wind up this company voluntarily, and Mr. Philip A. Latham, of 110, Cannon Street, has been appointed to act as liquidator, and to take steps to carry out the amalgamation agreed to with the Hammond Electric Light and Power Supply Company, Limited.

Western and Brazilian Telegraph Company, Limited.—The directors recommend a dividend at the rate of 2½ per cent. per annum, for the half-year ended September 30th last. This will allow the full dividend of 5 per cent. on the preferred shares.

Globe Telegraph and Trust Company, Limited.—An interim dividend is notified, payable on the 18th instant, of 3s. per share on the Preference shares, and of 2s. on the Ordinary shares.

German Union Telegraph and Trust Company, Limited.—An interim dividend is announced of 5s. 9d. per £10 share, payable on the 19th January.

Direct Spanish Telegraph Company, Limited.—The manager intimates that direct cable communication with Spain, *viâ* Bilbao, is now fully restored.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotatns, Jan. 9.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	8	1¾- 2¼	
		Do. Do.	10	4¼- 4¾	
30,000	5	Australasian E. L., Power & Storage Co.	3	..	
24,900	10	British Insulite Co., Ld., "A" Shares..	5	1 - 2	
30,000	5	Brush Elec. Lt. & Power Co. (Scotland)	2½	½- ¾	
25,000	5	Gt. Western Electric Light & Power Co.	2½	⅛- ⅜	
24,980	5	Hammond Elec. Lt. & Power Sply. Co.	5	1⅞- 2⅛	1 15/16. 2⅛. 1 15/16
40,000	5	Indian & Ori. Electl. Storage Wks. Co.	2	..	
250,000	1	Maxim-Weston Elec. Lt. & Power Co. ..	1	⅛- ¼	¼
100,000	5	Metrop. Brush Electric Lt. & Power Co.	3	..	
40,000	5	Pilsen-Joel & Gen. Elec. Lt. Co.	2½	..	
20,000	5	S. African Brush Elec. Lt. & Power Co.	2½	..	
100,000	5	Swan United Electric Light Co., Ld.....	2½	⅞- 1⅛	1
		TELEGRAPHS.			
1,892,480*l.*	Stk.	Anglo-American, Limited	100	43½- 44½	
2,553,760*l.*	Stk.	Do. Pref. } Def. receiving no div. until	100	73½- 74½	74⅛. ¼
2,553,760*l.*	Stk.	Do. Def. } 6 p. c. paid to Pref.........	100	13½- 14½	
130,000	10	Brazilian Submarine, Limited	10	10 - 10¼	10⅛. ¼
16,000	10	Cuba, Limited	10	10¾- 11¼	
6,000	10	Do. 10 per cent. Preference ..	10	17½- 18½	
13,000	10	Direct Spanish, Limited	9	4½- 5	
6,000	10	Do. 10 per cent. Preference ..	10	15 - 16	
65,000	20	Direct United States Cable, Ld., 1877 ..	20	10⅞- 11⅛	11⅛. ¼. ⅛. 10⅞
100,000*l.*	100	Do. 6 per cent. Deb., repayable 1884	100	100 -103	
380,000	10	Eastern, Limited	10	10⅞- 11⅛	10⅞. 11. ⅛
70,000	10	Do. 6 per cent. Preference......	10	13 - 13½	
232,000*l.*	100	Do. 6 do. Debs., repayable Oct. 1883	100	..	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101-104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	104-108	
250,000	10	Eastern Exten., Australasia & China, L.	10	11⅜- 11⅝	11 9/16
320,000*l.*	100	Do. 6 p. c. Debs., repayable Feb. 1891	100	108- 111	
500,000*l.*	100	Do. 5 p. c. (Aus. Gov. Sub.) Deb. 1900	100	101- 104	
140,000*l.*	100	Do. do. reg., repayable 1900..	100	101- 104	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101- 104	
550,000*l.*	100	Eastern & South African, Ld., 5 p. c. Mort. Deb. Rg. redeemable 1 Jan. 1900	100	101- 104	
	100	Do. do. do. To Bearer..	100	101- 104	
22,050	10	German Union Telegraph & Trust, Ld.	10	10¼- 10¾	10⅜. ½
250,000	10	Globe Telegraph & Trust, Ld.	10	7 - 7¼	7⅛
250,000	10	Do. 6 per cent. Preference	10	13 - 13¼	13
150,000	10	Great Northern	10	13 - 13¼	13⅛
100,000*l.*	100	Do. 5 per cent. Debentures ..	100	100 -103	
300,000*l.*	100	Do. 5 per cent. Debentures ..	100	103 -106	
81,200	10	India-Rubber, Gutta-Percha, & Tel. Wks.	10	30½- 31½	30⅜. ½
100,000	100	Do. 6 per cent. Debs., 1886	100	102 -105	
18,000	25	Indo-European, Limited	25	31½- 32½	
40,000	10	London Platino-Brazilian, Limited	10	3¼- 3¾	
12,000	10	Mediterranean Extension, Limited	10	1½- 2	
3,200	10	Do. 8 per cent. Preference	10	2 - 4	
10,000	8	Reuter's, Limited	8	8¾- 9¼	
338,225*l.*	Stk.	Submarine	100	200 -210	
75,000	1	Do. Scrip	1	1⅞- 2⅛	
4,200	Cert.	Submarine Cables Trust	100	104 -107	
37,350	12	Telegraph Construction and Mainten.	12	35½- 36½	36. ½
150,000	100	Do. 6 per cent. Bonds, 1884 ..	100	..	
186,750	5	Do. 2nd Bonus Trust Cert. ..	2½	1½- 1¾	
30,000	10	West Coast of America, Limited	10	5 - 5½	
150,000*l.*	100	Do. 8 per cent. Debs.	100	105 -107	
45,791	15	Western and Brazilian, Limited	15	5¼- 5½	5 7/16
24,119	7½	Do. Preferred	7½	4¼- 4¾	
24,119	7½	Do. Deferred	7½	⅞- 1⅛	
200,000*l.*	100	Do. 6 p. c.. Debs. "A" 1910 ..	100	103 -107	
250,000*l.*	100	Do. 6 p. c. Mort. Deb. B. '80, red. Feb. 1910	100	97 -100	
1,500	$1,000	Western Union 7 p. c. 1 Mort. (Bg.) Bds.	$1,000	120 -124	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	103 -107	
88,321	10	West India and Panama, Limited	10	1 - 1¼	1⅛
34,563	10	Do. 6 per cent. 1st Preference	10	7¼- 7¾	
4,669	10	Do. 6 do. 2nd do. ..	10	5 - 5½	
		TELEPHONES.			
224,850	1	Con. Tele. & Mainten., L., Nos. to 154,165	1	⅛- ⅜	
225,000	1	Oriental Tele. Co., Nos. 80,001 to 300,000	½	⅛- ⅜	¼
100,000	5	United Telephone Co.	5	8 - 8½	
20,000	5	Do. New, issued 2 p.m.	2	..	

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines of this company during the month of December was 2,774, estimated to produce £2,500, against 2,954 messages, producing £3,068 in the corresponding month of last year. The receipts for the month of September, estimated at £2,500, realised £2,515.

The West India and Panama Telegraph Company, Limited. The estimated receipts for the half-month ended the 31st December, 1883, are £2,267, as compared with £2,146 in the corresponding period of 1882. The September receipts, estimated at £4,615, realized £4.703.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending 4th January, 1884, were £2,125, after deducting the "fifth" of the gross receipts payable to The London Platino-Brazilian Telegraph Company, Limited.

The Great Northern Telegraph Company. The receipts in December, 1883, were £18,280. From 1st January to 31st December, 1883, £255,080. Corresponding month of 1882, £241,373; 1881, £234,850.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of December, 1883, are £1,461, against £1,346 in the corresponding period of last year.

The Eastern Telegraph Company. The receipts for December amounted to £49,281, and to £49,610 in the corresponding period of 1882.

The Brazilian Submarine Telegraph Company, Limited. The receipts for the week ended 4th January, amounted to £2,635.

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BRADFORD, YORKSHIRE	35, Kirkgate.	BRISTOL	37, Corn Street.
SHEFFIELD	10, Castle Street.	NEWPORT, MON.	82, Dock Street.
PORTSMOUTH	49, High Street.	CARDIFF ...	Pierhead Chambers, Bute Docks.

NEWCASTLE-ON-TYNE ... 31, Grainger Street, West.

LONDON: PRINTED AND PUBLISHED BY THE PROPRIETORS AT [illegible] AND [illegible], PATERNOSTER ROW E.C.—JANUARY 12, 1884.